



## “A Study on Occurrence, Risk Factors and Cardiovascular Event Associated with QT Interval Prolongation and Increased Dispersion in Newly Diagnosed Hypertension Patients”

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### KEYWORDS

Hypertension, QT interval prolongation, cardiovascular risk, Framingham Risk Score, gender differences, smoking.

### ABSTRACT:

**Background:** Systemic hypertension is a widely prevalent non-communicable disease in India, impacting approximately 21–25% of the population. It is commonly linked to cardiovascular complications and target organ damage. Notably, changes in cardiac electrical activity, such as QT interval prolongation and increased dispersion, serve as important indicators associated with arrhythmias and sudden cardiac death. However, there is limited data on these parameters in patients newly diagnosed with hypertension.

**Aim:** This study aimed to determine the occurrence and risk factors associated with QT interval prolongation and increased dispersion in newly diagnosed hypertensive patients.

**Materials and Methods:** An observational cross-sectional study was conducted at Aarupadi Veedu Medical College, Puducherry, over an 18-month period. A total of 140 consecutive patients, newly diagnosed with hypertension based on JNC 8 guidelines (mean age 49.2 years; 58.6% male; 22.1% smokers), were enrolled. Comprehensive demographic, anthropometric, and biochemical data were collected. Electrocardiograms (ECGs) were performed, and the QT interval was measured using Bazett's formula. Cardiovascular risk was further evaluated using the Framingham Risk Score (FRS).

**Results:** QT prolongation was present in 65.7% of cases, with 65% of patients exhibiting an FRS >1%. Notably, male patients showed a significantly higher incidence of both QT prolongation (73.2% vs. 55.2%) and elevated FRS (76.8% vs. 48.3%) compared to females ( $p < 0.05$ ). In patients with QTc prolongation, an FRS >1% was found in 85% of males and 68.8% of females, while among smokers, a significantly higher association was observed in males (52.9% vs. 18.2%,  $p < 0.05$ ).

**Conclusion:** The study demonstrates a high occurrence of QT interval prolongation in newly diagnosed hypertensive patients, particularly among males and smokers. Early risk stratification and targeted interventions are recommended to mitigate future cardiovascular events.



### Introduction:

Systemic hypertension is the common non-communicable disease in India. “The prevalence has been estimated to be between 21% and 25% of the Indian population majority of whom are not aware of their hypertension status.<sup>1-3</sup> Hypertension is often associated with many other cardiovascular risk factors.

Hypertension contributes to various target organ damages, including left ventricular hypertrophy, microalbuminuria, heart failure, retinopathy, peripheral artery disease, coronary artery disease, and stroke. It remains a significant public health concern, impacting millions of people globally.<sup>4</sup> One of the major complications of hypertension is cardiovascular disease. Research indicates that hypertension can alter the heart's electrical properties, increasing the risk of arrhythmias and sudden cardiac death. QT interval prolongation and increased dispersion are key indicators of cardiac electrical instability, often linked to hypertension and other cardiovascular conditions.<sup>5,6</sup> QT interval prolongation refers to an increase in the duration of the QT interval on an electrocardiogram (ECG), while increased dispersion refers to a wider spread of repolarization times between different parts of the heart. Both parameters are predictive of an increased risk of arrhythmia and sudden cardiac death.<sup>5</sup>

Limited data exist on the occurrence and risk factors of QT interval prolongation and increased dispersion in newly diagnosed hypertensive patients. Identifying these factors could aid clinicians in recognizing high-risk individuals and optimizing their management. This study aims to explore the prevalence and contributing factors of these cardiac electrical abnormalities in newly diagnosed hypertension. The information obtained from this study will aid in the early identification of high-risk hypertensive patients and the development of targeted interventions.

### Material & Method:

The study was conducted at Aarupadai Veedu Medical College, Puducherry, in the OPD and IPD of the Department of General Medicine, the hypertensive clinic, and the master health check-up unit. It was an observational cross-sectional study with a sample size of 140 participants selected consecutively over 18 months. The sample size was calculated based on a previous study

conducted at Sri Manakula Vinayagar Medical College, Puducherry, in 2022, which reported a 52.2% occurrence of cardiovascular risk. Participants included newly diagnosed hypertensive patients (within three months) aged 18 years or older, following JNC 8 guidelines. Patients with a history of cardiac, hepatic, renal, neurological, or thyroid disorders, substance abuse, pregnancy, or QT-prolonging electrolyte imbalances were excluded.

The study aimed to assess QT interval prolongation and dispersion using ECG measurements and correlate them with cardiovascular risk factors using Framingham risk scores. Data were collected using a structured proforma and analyzed using SPSS v23.0, with statistical methods including logistic regression to identify risk factors, linear regression to assess relationships with hypertension severity, and Cox regression to evaluate cardiovascular event risk. Ethical considerations ensured participant safety, informed consent, and confidentiality, with the study categorized as low risk. Institutional funding supported the research. The expected outcome was to determine whether QT prolongation occurs in newly diagnosed hypertensive patients, enabling early interventions to prevent future cardiovascular events.

**Statistical Analysis:** Data were collected using a proforma, entered into an Excel sheet, and analyzed with SPSS v23.0 on Windows 10. Summary statistics included mean, standard deviation, frequency, and percentage, presented through tables and charts. Descriptive statistics determined QT interval prolongation and dispersion occurrence. A p-value of <0.05 was considered statistically significant.

**Result:** Present study included total of 140 cases newly diagnosed hypertensive fulfilling inclusion criteria. The mean age of patients was found to be 49.2yrs. Among them 58.6% were male patients and 41.4% were female patients.

	Mean	SD
Age	49.20	10.429
Height	158.5	7.9
Weight	55.7	10.2



BMI	22.0	2.6
Hb	12.3	1.2
TLC	6.61	1.78
Urea	25.80	10.10
Creatinine	.90	.22
PR	81.55	7.37
SBP	168.31	14.32
DBP	106.63	12.3

The data indicates that the average height is 158.5 cm with a standard deviation of 7.9, suggesting that most individuals have heights clustered around this value. Similarly, an average weight of 55.7 kg with a standard deviation of 10.2 shows moderate variability in body weight among the sample. The mean BMI of 22.0, with a standard deviation of 2.6, suggests that the group generally falls within a healthy range, with only slight variations in body composition. Urea levels have a mean of 25.80 mg/dL and a larger standard deviation of 10.10, suggesting greater variation in urea concentrations across the sample. Finally, creatinine levels average 0.90 mg/dL with a standard deviation of 0.22, reflecting relatively consistent kidney function.

Table 2: Showing distribution of patients

		Count	N %
Gender	Female	58	41.4%
	Male	82	58.6%
Smokers	No smoker	109	77.9%
	Smokers	31	22.1%
QT Prolongation (QTc)	Absent	48	34.3%
	Present	92	65.7%
FRS	<1%	49	35.0%
	>1%	91	65.0%

Present study documented with QT prolongation present in 65.7% of cases and normal QT in 34.3%. The FRS showing higher risk of >1% was present in 65% of the cases and <1% in 35%.

Table 3: Association of the QT prolongation and FRS score with gender of patients

		Gender				Chi-square (p-value)
		Female		Male		
		Count	N %	Count	N %	
QT Prolongation (QTc)	Absent	26	44.8%	22	26.8%	4.88 (0.02)*
	Present	32	55.2%	60	73.2%	
FRS	<1%	30	51.7%	19	23.2%	12.17 (0.01)*
	>1%	28	48.3%	63	76.8%	



There is significant higher incidence of QT prolongation (QTc) and FRS >1% among the males (73.2% and 76.8% respectively) compared to female patients (55.2% and 48.3% respectively).(p<0.05)

Table 4: Association of the QT prolongation (QTc) with FRS score among patients

		QT Prolongation (QTc)				Chi-square (p-value)
		Absent		Present		
		Count	N %	Count	N %	
FRS	<1%	30	62.5%	19	20.7%	24.28 (0.01)*
	>1%	18	37.5%	73	79.3%	

There is significant higher association of the FRS >1% with presence of QT prolongation (QTc) among the patients (79.3%).(p<0.05)

Table 5: Comparison of lipid parameters with FRS among patients

Lipid profile parameters	FRS <1%		FRS >1%		p-value
	Mean	SD	Mean	SD	
T. Cholesterol	196.21	22.1	224.6	32.4	0.01*
Triglycerides	189.32	15.33	192.37	16.3	0.32
LDL Cholesterol	112.6	12.21	140.39	11.64	0.05*
HDL cholesterol	38.32	4.68	32.38	3.96	0.05*

There is significant difference in mean level of lipid profile parameters with FRS. The mean level of Total cholesterol, LDL cholesterol was found to be significantly higher in FRS >1% compared to patients with <1%. Similarly, the mean HDL was significantly

Table 6: Association of the QT prolongation (QTc) with FRS score in relation with gender of patients

		QT Prolongation (QTc)							
		Absent				Present			
		Female		Male		Female		Male	
		Count	N %	Count	N %	Count	Clumn N %	Count	N %
FRS	<1%	20	76.9%	10	45.5%	10	31.3%	9	15.0%
	>1%	6	23.1%	12	54.5%	22	68.8%	51	85.0%
Chi-square (p-value)		5.03 (0.02)*				3.36 (0.05)*			

There is significant higher incidence of male with FRS>1% with QT prolongation (QTc) present. When QT prolongation (QTc) was present, FRS was >1% in 85% males and 68.8% females. Similarly when QT prolongation (QTc) was absent the FRS >1% was present in 54.5% males and 23.1% female patients.



Table 7: Association of blood pressure with QTc levels

		QTc				Chi-square (p-value)
		<475		>475		
		Count	N %	Count	N %	
BP	<160/110	32	51.7%	15	19.3%	33.20 (0.05)
	>160/110	30	48.3%	63	80.7%	

There is significant higher incidence of higher QTc among the patients with blood pressure >160/110mmHg.(p<0.05)

### Discussion:

Present study included in total 140 cases of newly diagnosed hypertension fulfilling the inclusion criteria. The mean age of patients was found to be 49.2yrs. Among them 58.6% were male patients and 41.4% were female patients and smoking was present in 22.1% of participants. In concordance Akintunde AA et al., considered 103 patients with 64.4% being male and 35.6% female.<sup>5</sup> In a study by Solanki JD et al., the mean age was found to be 40yrs.<sup>7</sup> Also in study by Minkah F et al., hypertensive patients had a mean age of 50.99±6.73 years compared to 48.19±7.17 years in controls (p=0.63) and were predominantly female (1:2.4 male-to-female ratio).<sup>8</sup>

Present study documented with QT prolongation present in 65.7% of cases and normal QT in 34.3%. The FRS showing higher risk of >1% was present in 65% of the cases and <1% in 35%. There is significant higher incidence of higher QTc among the patients with blood pressure >160/110mmHg.(p<0.05) In concordance Akintunde AA et al., documented with QTc prolongation in 52.5% of the cases. Additionally, 26% of participants were smokers, 27% consumed alcohol, and 60% had coexisting diabetes mellitus.<sup>5</sup> QT duration was poorly associated with increasing age but was associated with strongly having longer duration due to an unknown mechanism. This was study Hypertension appears to prolong QT interval in an undefined manner, particularly in female in study by Chundusu M et al.<sup>9</sup> Another study by Janakiraman S et al., documented with QTc prolongation was observed in 52.5% of the participants, with a higher prevalence among poorly controlled hypertensive individuals (59%) compared to those with controlled hypertension (37.5%). Additionally, 26% of participants were smokers, 27% consumed alcohol, and 60% had coexisting diabetes mellitus.<sup>10</sup> In study by

Minkah F et al., the “prevalence of increased QTcd was significantly higher in hypertensive patients (45.0%) than in controls (16.5%) ( $\chi^2=38.14$ , p<0.001, odds ratio=4.14). The study concluded that increased QTcd is common among hypertensive Ghanaians and recommended its use as a non-invasive screening tool to risk-stratify hypertensive patients.”<sup>8</sup>

The results indicate that male patients exhibit a significantly higher occurrence of both QT prolongation and elevated cardiovascular risk (FRS >1%) compared to females. Specifically, 73.2% of males had QT prolongation versus 55.2% of females, and 76.8% of males had an FRS >1% compared to 48.3% of females. Additionally, there was a strong overall association between QT prolongation and an FRS >1%, with 79.3% of patients with prolonged QT also showing high risk. When examining the data more closely, 85% of males with QT prolongation had an FRS >1%, compared to 68.8% of females; whereas in patients without QT prolongation, the prevalence of FRS >1% was 54.5% in males and 23.1% in females. Among smokers, this association was even more pronounced, with 52.9% of male smokers with QT prolongation having an FRS >1% compared to 18.2% of female smokers. A study by Sahranavard T et al. found that older age, hypercholesterolemia, hypertension, type 2 diabetes mellitus (T2DM), severe anxiety, and mild depression in men, as well as hypertension and T2DM in women, were linked to an increased risk of QTc interval prolongation. Healthcare providers should be aware of these risk factors and take necessary precautions to prevent complications associated with prolonged QTc intervals.<sup>11</sup> Similar to the present study, Solanki JD et al. concluded that QTc prolongation is more common in newly diagnosed hypertension. These findings emphasize the need for early hypertension screening, routine QTc measurement, and timely preventive interventions to



reduce the risk of repolarization abnormalities and associated adverse events.<sup>7</sup>

#### Conclusion:

In conclusion, our study of 140 newly diagnosed hypertensive patients demonstrates a high occurrence of QT interval prolongation, present in 65.7% of cases, alongside a significant cardiovascular risk as indicated by an FRS >1% in 65% of patients. Notably, male patients exhibited a significantly higher incidence of both QT prolongation and elevated FRS compared to females, with these associations further intensified among smokers. The strong correlation between higher FRS scores and the presence of QT prolongation—especially in males (with 85% of males with QT prolongation showing an FRS >1% compared to 68.8% of females)—underscores the critical role of gender and smoking status as risk factors. These findings highlight the importance of early risk stratification and targeted intervention in newly diagnosed hypertensive patients to potentially mitigate future cardiovascular events.

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#### Reference:

1. Anchala R, Kannuri NK, Pant H, Khan H, Franco OH, Di Angelantonio E, et al. Hypertension in India: a systematic review and meta-analysis of prevalence, awareness, and control of hypertension. *J Hypertens*. 2014;32(6):1170–7.
2. Gupta R, Xavier D. Hypertension: The most important non communicable disease risk factor in India. *Indian Heart J*. 2018;70(4):565–72.
3. Koya SF, Pilakkadavath Z, Chandran P, Wilson T, Kuriakose S, Akbar SK, et al. Hypertension control rate in India: systematic review and meta-analysis of population-level non-interventional studies, 2001–2022. *Lancet Reg Heal - Southeast Asia*. 2023;9.
4. Petrie JR, Guzik TJ, Touyz RM. Diabetes, Hypertension, and Cardiovascular Disease: Clinical Insights and Vascular Mechanisms. *Can J Cardiol*. 2018;34(5):575–84.
5. Fuchs FD, Whelton PK. High Blood Pressure and Cardiovascular Disease. *Hypertension*. 2020;75(2):285–92.
6. Akintunde AA, Ayodele OE, Opadijo OG, Oyedeji AT, Familoni OB. QT Interval prolongation and dispersion: Epidemiology and clinical correlates in subjects with newly diagnosed systemic hypertension in Nigeria. *J Cardiovasc Dis Res*. 2012;3(4):290–5.
7. Welten SJGC, Elders PJM, Rimmelzwaal S, Doekhie R, Kee KW, Nijpels G, et al. Prolongation of the heart rate-corrected QT interval is associated with cardiovascular diseases: Systematic review and meta-analysis. *Arch Cardiovasc Dis*. 2023;116(2):69–78.
8. Solanki JD, Gadhavi BP, Makwana AH, Mehta HB, Shah CJ, Gokhale PA. QTc interval in young Gujarati hypertensives: Effect of disease, antihypertensive monotherapy, and coexisting risk factors. *J Pharmacol Pharmacother*. 2016;7(4):165–70.
9. Minkah Md Fwaep DO, Owusu IK, Kokuro C, Norman BR, Arthur JA, Ogyefo IN, et al. Prevalence of Increased QTc Dispersion Among Hypertensive Patients and Its Correlation to Clinical Risk Factors: A Hospital-Based Case-Control Study. *Cureus*. 2024;16(3):e56423.
10. Chundusu CM, Danbauchi SS, Okeahialam BN. Corrected QT Interval in Hypertension Seen in a Tertiary Health Institution in North Central Nigeria. 2018;
11. Janakiraman S, Arivazhagan RB, Chinnusamy M. Prevalence of QTc prolongation among hypertensive patients and its association with other co-morbidities. 2022;1–2.
12. Sahranavard T, Soflaei SS, Alimi R, Pourali G, Nasrabadi M, Yadollahi A, et al. Factors associated with prolonged QTc interval in Iranian population: MASHAD cohort study. *J Electrocardiol*. 2024;84:112–22.