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Predictive Value and Association between Microalbuminuria & Prolonged QTC Interval in Hypertensive Patients

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Abstract:
Background: *Hypertension is a major cause of morbidity and mortality in India. Present study was undertaken to correlate microalbuminuria and QTc interval in patients with hypertension.*
Methodology: *Thirty patients of hypertension fulfilling the inclusion criteria coming to OPD/Wards of MGUMST, Jaipur were recruited. They were subjected to detailed history (as per the performa), clinical and diagnostic examination. Data analysis was done using SPSS software.*
Results: *Prevalence of QTc prolongation was 46.7% and prevalence of microalbuminuria was 73.33% in hypertensive patients. There was a significant association between QTc interval prolongation and microalbuminuria.*
Conclusion: *In hypertension there is a high prevalence and positive association between prolonged QTc interval and microalbuminuria. We recommend screening for microalbuminuria in newly diagnosed hypertensive patients to look for the presence of CAN (prolonged QTc interval) in positive cases.*
Keywords: *hypertension, microalbuminuria, electrocardiography*

I. Introduction

Hypertension is an important worldwide public-health challenge because of its high frequency and concomitant risks of cardiovascular and kidney disease

(1, 2). It has been identified as the leading risk factor for mortality, and is ranked third as a cause of disability-adjusted life-years (3).

Microalbuminuria is currently considered as a strong predictor of premature cardiovascular death in these populations. There are emerging data that reduction of microalbuminuria leads to reduced risk of adverse renal and cardiovascular events. The random, spot urine ACR is the office test for microalbuminuria recommended as part of the cardiovascular risk assessment (4).

Cardiac autonomic neuropathy (CAN) is a serious and common complication of hypertension. It is associated with a variety of adverse outcomes including cardiovascular death. Prolongation of the corrected QT interval (QTc) has been demonstrated to be a specific indicator of CAN in most studies. Thus, QTc prolongation could be utilized as a rapid objective method to target the people at high risk of cardiovascular events (5).

According to past literature, many studies have been done on the association of QT interval abnormalities and microalbuminuria in diabetic patients and there are only a few reports in hypertensive patients.

This study is intended to study cardiac autonomic neuropathy as predicted by prolonged QTc interval and its association with microalbuminuria in patients suffering from hypertension and to correlate it to duration.

II. Material And Methods

The present study was conducted in Mahatma Gandhi Medical College and Hospital, Jaipur. The present study was a cross sectional study on 30 patients of Hypertension meeting inclusion and exclusion criteria as mentioned below.

Inclusion criteria

- Patients with hypertension.

Exclusion Criteria:

- History of MI / Angina
- Clinical evidence of heart failure
- Left bundle branch block
- Atrial fibrillation
- Febrile illness

- Urinary tract infection
- H/o drug intake like ACE/ARB's
- Acute poor metabolic control
- Smoking
- High serum calcium levels

After applying above inclusion and exclusion criteria, the 30 patients were selected on the basis of simple random sampling method and detailed history and thorough clinical examination was done as indicated in the performa. The patients were subjected to ECG (to calculate QTc interval. Average of 3 QT and RR intervals from the leads where QT interval is easily identified to calculate this by BAZZET's formula – QT / √RR ms). NycoCard™ U-Albumin is a rapid in vitro test for measurement of low albumin concentrations in human urine.

III. Results

Table 1: Association of QTc Prolongation (CAN) with Microalbuminuria in Hypertension cases

Group	Microalbuminuria (30-300 µg/mg Cr.)	QTc Prolongation (>440 m sec)		Total
		Present	Absent	
HTN	Normoalbuminuria (<30)	1 (12.5%)	7 (87.5%)	8 (100%)
	Microalbuminuria (30-300)	13 (59.1%)	9 (40.9%)	22 (100%)
	Total	14 (46.7%)	16 (53.3%)	30 (100%)

Chi-square: 5.12, p-value < 0.05

This table shows that out of 30 cases with HTN, 14 cases have QTc prolongation and 22 cases have Microalbuminuria. Out of 22 cases of Microalbuminuria, 13 cases had QTc Prolongation (59.1%) and 9 cases did not show QTc Prolongation. Out of 8 cases with normoalbuminuria, 1 case showed QTc Prolongation and 7 cases did not.
P value < 0.05 is statistically significant.

Table 2: Correlation between Duration of Hypertension and QTc Prolongation

Duration (Years)	HTN		
	QTc Prolongation		
	Present	Absent	Total
<5	5 (27.8%)	13 (72.2%)	18 (100.0%)
5-10	9 (75.0%)	3 (25.0%)	12 (100.0%)
Total	14 (46.7%)	16 (53.3%)	30.0 (100.0%)
Mean Duration ± S.D	5.65 ±2.451	3.34 ±3.327	

Chi square: 6.451; p<0.01

Mean duration of Hypertension with QTc Prolongation comes to 5.65±2.45 years and for the cases without QTc Prolongation was 3.34±3.27; (t=2.205; p<0.05). This comparison of mean duration shows that the duration of hypertension has significant association with the chances of QTc prolongation.

In Hypertension group 18 cases were observed with <5 year duration, out of which 5 cases (27.8%) had QTc prolongation. In 5-10 year duration 12 cases were observed, out of which 9 cases (75.0%) had QTc prolongation. This was statistically significant, showing significant association of QTc prolongation with increased duration of disease (p value <0.01).

Table 3: Correlation between Duration of Hypertension and Microalbuminuria

Group	Duration (years)	Microalbuminuria		Total
		Normoalbuminuria	Microalbuminuria	
HTN	<5	7 (38.9%)	11 (61.1%)	18 (100.0%)
	5-10	1 (8.3%)	11 (91.7%)	12 (100.0%)
	Total	8 (26.7%)	22 (73.3%)	30 (100.0%)

Chi square = 3.438; p > 0.05

Mean duration of Hypertension with microalbuminuria comes to 3.9 years (S.D - 3.259). In our study, in HTN group, out of 18 cases with <5 year duration, 11 (61.1%) cases were observed with microalbuminuria. In 5-10 year duration out of 12 cases 11 (91.7%) had Microalbuminuria. Statistically this was not significant (p>0.05). However, 95% CI for the risk in exposed was 38.89%. The lower limit was 20.23 and the upper limit was 61.46, which indicates that there is higher probability of presence of Microalbuminuria with increase in duration of disease.

IV. Discussion

This study was intended to study the association between prolonged QTc interval (CAN) and microalbuminuria in hypertensive patients.

In our study, positive association is found between microalbuminuria and prolonged QTc interval in hypertensive patients. Out of 22 patients of HTN with microalbuminuria, 13 (59.1%) patients had prolonged QTc interval, which was statistically significant.

Our result correlates well with other studies.

In the study done by **Olusegun. et al (2010),** significant positive correlation was found between microalbuminuria and prolonged QT interval in hypertensive patients with 16.1% of patients with microalbuminuria had prolonged QT interval p=0.001(6).

In our study, in hypertensive group 18 cases were observed with <5 yr duration, out of which 5 cases (27.8%) showed prolonged QTc interval. In 5-10 yr duration 12 cases were observed, out of which 9 (75%) were found to have prolonged QTc interval .Statistically this was significant showing that increasing duration of hypertension significantly contributes to QTc prolongation. In our study in HTN group out of 18 cases with <5 yr duration, 11(61.1%) cases were observed with microalbuminuria. In 5-10 yr duration, 11 (91.7%) out of 12 cases had microalbuminuria. Statistically this was not significant (χ^2=3.43; p>0.05). However, 95% CI for the risk in exposed was 38.89%. The lower limit was 20.23 and the upper limit was 61.46, which indicates that there is higher probability of presence of microalbuminuria with increase in duration of disease.

Our result correlates with the study done by Sabharwal RK. et al (2008), who did not found any correlation between duration of hypertension and microalbuminuria (r^2 =0.0042) (7). Thus the casual detection of microalbuminuria and QTc prolongation in hypertensive patients should alert the clinician to the coexistence of CVD risk factors and warrant further evaluation and treatment.

V. Conclusion

In our study we found that there was a high prevalence of Cardiac Autonomic Neuropathy (CAN) (as predicted by prolonged QTc interval in ECG) and Diabetic Nephropathy (as predicted by microalbuminuria) in patients with HTN. Also, the prevalence increased with increase in duration and severity of the disease.

This signifies that metabolic disturbances in HTN acts independently in causing these microvascular complications and when combined together have got synergistic effect. This implies that early diagnosis, timely and effective treatment can help in preventing these complications to some extent.

We also found positive association between microalbuminuria and prolonged QTc interval in hypertensive patients. Thus, microalbuminuria signifies QTc prolongation in patients with HTN. It indicates excess cardiovascular morbidity and mortality in these patients. We recommend screening for microalbuminuria in newly diagnosed hypertensive patients and to look for the presence of CAN (prolonged QTc interval) in positive cases. This will help in taking timely therapeutic measures to prevent any major adverse cardiovascular event.

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