ORIGINAL ARTICLE

Comparison of QTc interval, QRS duration and JTc Interval to Predict Repolarisation Abnormality in Intra-Ventricular Conduction Disturbance Patients – A Study Conducted in Medical College Kolkata

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ABSTRACT

Introduction: Disturbances of intra-ventricular conduction are associated with distinct ECG abnormalities inpatients and QTc interval is found to be prolonged which may be interpreted as higher arrhythmogenic property of such patients. But the repolarisation time of such patients are more or less same which isexpressed by JTc interval. In this study, it is found that JTc interval measurement is more significant than QTc interval in IVCD patients as predictor of cardiac arrhythmogenesis.

Methodology: Institution based observational, cross sectional study among 100 patients attending cardiology OPD for a period of approximate 2 years with diagnosis of different IVCDs (RBBB, LBBB, BFB) on surface ECG .QRS, QTc, JTc interval were measured.

Result: Mean QRS and QTc value were more for LBBB group as compared to RBBB and BFB group. But corrected JTc value was more or less equal in three groups. Post HOC analysis showed that there was no significant correlation of JTc interval between all the three groups. JTc interval was not found to be statistically significant indicating that repolarisation abnormality is minimum in both RBBB, LBBB and BFB group.

Conclusion: JTc interval is not significantly high in LBBB patients indicating long QTcin LBBB is due to depolarization abnormality rather than repolarisation abnormality and not a predictor of arrhythmogenesis.

Keywords: IVCD, QTC interval, JTc interval, arrhythmogenesis

INTRODUCTION

Anintra-ventricular conduction disturbance (IVCD) refers to disturbance in intra-ventricular propagation of supraventricular impulses resulting in change in QRS complex either in morphology or duration or both. Disturbances of intra-ventricular conduction are associated with distinct electrocardiographic abnormalities.[1, 2] Intra-ventricular conduction defects can be a marker of underlying clinically significant heart disease and may have independent prognostic importance as a precursor of complete heart block, arrhythmia, cardiac syncope or sudden death.[3-10] On surface ECG of these patients, QTc interval is found to be prolonged which may be interpreted as higher arrhythmogenic property of such patients, but the repolarisation time of such patients are more or less same and it is expressed by JTc interval . In this study, it is found that JTc interval measurementis more significant than QTc interval in IVCD patients as the later represents repolarisation abnormality which is the time of cardiac arrhythmogenesis.

The present study was conducted to evaluate mean QRS duration, QTc and JTc interval in different IVCD patients commonly presented at OPD and also to compare QRS interval with QTc and JTc interval to detect any significant repolarisation abnormality of such patients and risk of arrhythmia in such patients.

METHODOLOGY

It is an institution based observational, cross sectional study among approximate 100 patients attending cardiology OPD with major cardiovascular complications like congestive heart failure, AMI, arrhythmia to minor symptoms of dizziness, palpitation, syncope, chest pain having different types of interventricular conduction defects on surface ECG. The study was conducted for a period of approximate 2 years (January 2016to January 2018). Pre- designed, semi - questionnaire form will be created and applied for the study population. Few personal history and family history of cardiovascular disease were taken .LBBB is defined as prolonged QRS duration of ≥ 0.12 s associated with a broad, notched R wave without q waves in leads I, aVL, and V6, and an rS pattern in lead V1.[11] RBBB is prolonged QRS duration of ≥ 0.12 s associated with an R, rSR', or qR wave in lead V1; wide, slurred S waves in leads I, aVL, V5, and V6; and a wide terminalr wave in aVR.[12] Bifascicular

block is the combination of RBBB with either LAFB or LPFB. Though according to some opinion, LBBB is also one type of bifascicular block, but for present study the above mentioned criteria is considered for Bifascicular block. QRS duration, QT interval were measured. The corrected QT interval (QTc) estimates the QT interval at a heart rate of 60 bpm. This allows comparison of QT values over time at different heart rates and improves detection of patients at increased risk of arrhythmias. There are multiple formulas used to estimate QTc .It is not clear which formula is the most useful. Here in the study, the most commonly used formula i.e. Bazett's formula (**QTC** = QT / √ RR) was used for measurement of QTc duration in this study, JTc interval is calculated from J point to end of T wave. Analyses was performed using SPSS (v 19.0) software.

RESULTS

In the study group, mean age was 55.77 ±12.228 years where minimum age was 20 years and maximum was 86 years (N =100) frequency distribution of types of intra-ventricular conduction defect in study population (RBBB, LBBB, BFB) shows that 37% were RBBB group, 49% were LBBB group and rest of them had bifascicular block on ECG . Mean QRS were 176.38msec, 199.84msec and 181.43msec for RBBB, LBBB, BFB patients respectively. Mean QTc interval were 456.378 msec, 474.714 msec, 453.571 msec for RBBB, LBBB and BFB patients respectively. Mean JTc interval were 280.108 msec, 274.878 msec, 272.143 msec for RBBB, LBBB and BFB patients respectively (**vide table 1**)

Table 1: Frequency distribution of types of intra-ventricular conduction defect in study population (RBBB, LBBB, BFB) with mean QRS, QTc and JTc interval (n=100)

Types	Frequency	Percent	Mean QRS(msec)	Mean QT c(msec)	Mean JTc(msec)
RBBB	37	37.0	176.38	456.378	280.108
LBBB	49	49.0	199.84	474.714	274.878
BFB	14	14.0	181.43	453.571	272.143

Table 2: ANOVA testing of QRS, QTc and JTc in three bundle branch block groups (n=100)

		Sum of Squares	df	Mean Square	F	Sig.
JTc	Between Groups	875.963	2	437.981	.339	0.713
	Within Groups	125214.547	97	1290.872		
	Total	126090.510	99			
QTC	Between Groups	9202.779	2	4601.389	11.751	0.000
	Within Groups	37984.131	97	391.589		
	Total	47186.910	99			
QRS	Between Groups	12433.535	2	6216.767	3.572	0.032
	Within Groups	168816.825	97	1740.380		
	Total	181250.360	99			

Table 3: Post HOC analysis of QTC duration between each groups. (n=100)

Dependent variable	(I) IVCD	(J) IVCD	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower bound	Upper bound
QTc	RBBB	LBBB	-18.3359*	4.3099	**.000**	-28.594	-8.077
		BFB	2.8069	6.2092	.894	-11.972	17.586
	LBBB	RBBB	18.3359*	4.3099	**.000**	8.077	28.594
		BFB	21.1429*	5.9969	**.002**	6.869	35.417
	BFB	RBBB	-2.8069	6.2092	.894	-17.586	11.972
		LBBB	-21.1429*	5.9969	**.002**	-35.417	-6.869

Table 4: Post HOC analysis of QRS duration between each groups (n=100)

Dependent variables	IVCD	IVCD	Mean difference	Standard error	Significance	95% confidence interval	
						Upper boundary	Lower boundary
QRS	RBBB	LBBB	-23.458*	9.086	**.030**	-45.09	-1.83
		BFB	-5.050	13.090	.921	-36.21	26.11
	LBBB	RBBB	23.458*	9.086	**.030**	1.83	45.09
		BFB	18.408	12.642	.317	-11.68	48.50
	BFB	RBBB	5.050	13.090	.921	-26.11	36.21
		LBBB	-18.408	12.642	.317	-48.50	11.68

Table 5: Post HOC analysis of JTc duration between each groups

Dependent Variable	(I) IVCD	(J) IVCD	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
JTc	RBBB	LBBB	5.2306	7.8251	.782	-13.395	23.856
		BFB	7.9653	11.2736	.760	-18.868	34.799
	LBBB	RBBB	-5.2306	7.8251	.782	-23.856	13.395
		BFB	2.7347	10.8880	.966	-23.181	28.651
	BFB	RBBB	-7.9653	11.2736	.760	-34.799	18.868
		LBBB	-2.7347	10.8880	.966	-28.651	23.181

Mean QRS and corrected QT value is more for LBBB group as compared to RBBB and BFB group . But corrected JT c value was more or less equal in three groups. ANOVA testing of QRS, QTc and JTc in three bundle branch block groups were done. It shows QTc and QRS duration are more in LBBB group as compared to RBBB and BFB group (statistically significant, p value = 0.000 for QTc and 0.032 for QRS duration) while JTc duration (QTc- QRS) is not said to be statistically significant in the three groups (p value= 0.713) (**vide table 2**).

Post HOC analysis shows compared to RBBB and BFB, LBBB patients has more QTC (p value – 0.000for LBBB and RBBB comparison & 0.002 for LBBB and BFB comparison) – statistically significant (**vide table 3**).Post HOC analysis also shows that compare to RBBB, LBBB patients has more QRS duration (p value – 0.03 between LBBB and RBBB which is statistically significant) (**vide table 4**). Regarding JTc interval, post HOC analysis shows that there was no significant correlation of JTc interval between all the three groups **(vide table 5)**

DISCUSSION

The QT interval of the electrocardiogram is prolonged in right and left bundle-branch block. Since the QT interval is not prolonged outside the normal range due to myocardial disease alone, this lengthening of the QT interval is due to the conduction defect and is probably due to delayed depolarization. In various type of intra-ventricular conduction disturbances, QTc interval is prolonged because of lengthening of QRS duration. In those cases QTc interval will not represent ventricular repolarisation . Since we have measured JTc interval which may actually reflect the ventricular repolarisation time in patients with various types of IVCD. In a study by S Talbot[13], there was a significant difference in the QT interval in left and right bundle-branch block ($t = 386$; $p < 0.001$), since the QT was shorter in right than in left bundle-branch block . In this study, QTc and QRS duration are more in LBBB group as compared to RBBB and BFB group (by ANOVA test and Post HOC analysis) and p value is found to be statistically significant . In another study by Tabatabaei P et al[14], it was aimed to apply corrected JT interval (JTc) as an appropriate measure of ventricular polarization for predicting QTc in a formula. There was no significant correlation between JTc and QRS complex duration. A significant correlation was seen between QRS and QTc . This confirmed that JTc, as an index of repolarization, is independent of ventricular depolarization . Therefore, it can be applied for predicting QTc in patients with LBBB .similarly in this study, the JTC duration which is the gap of QTC and QRS interval is not found to be statistically significant which denotes that repolarisation abnormality is minimum in both RBBB, LBBB and BFB group .

CONCLUSION

QTc interval, which is prolonged in case of intraventricular conduction defect is commonly due to depolarization abnormality (prolonged QRS) rather than repolarisation abnormality . In presence of such bundle branch blocks, repolarisation abnormality is best predicted by JTc interval. In this study, LBBB patients have prolonged QTc and QRS interval as compared to RBBB patients (statistically significant). JTc interval is not significantly high in LBBB patients indicating long QTc in LBBB is due to depolarization abnormality rather than repolarisation abnormality and not a predictor of arrhythmogenesis. Rather JTc may be a good predictor of risk ofarrhythmia in these patients. further large studies are required in this field to establish this correlation with further types of IVCD (fragmented, splintered, ventricular paced rhythm) which are not included in the present study

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