

Assessment of Right Ventricular Systolic Function using Myocardial Performing Index (Tie Index) in Patients with Right Bundle Branch Block

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Abstract

Background: The impact of a RBBB in cases with structural heart disease on cardiac function has been evaluated extensively. However, literature about the impact of an RBBB without structural heart disease on right ventricle systolic function of the right ventricle is limited.

Aim: To assess right ventricular systolic function in patients with complete RBBB using tie index.

Material and Methods: Hospital based observational study in 120 patients aged ≥ 15 years. Cases (60) consisted of patients with isolated complete right bundle branch blocks without structural heart disease while the control group consisted of 60 healthy adults. The diameter, end-systolic area, and right ventricular (RV) fractional area, pulse wave tissue velocity at lateral tricuspid annulus, TAPSE and E/A ratio were obtained to evaluate RV morphologic and systolic and function.

Results: Although, the measurements of, TAPSE, RIMP and S' at lateral tricuspid tissue annulus were in normal limits in block group but there was statistical significant difference in between the patients with blocks and controls ($p < 0.05$). The myocardial performance index (Tei index) of the lateral tricuspid tissue annulus was significantly increased. Chi square test and t test was applied to compare the same variable between the group and p value of ≤ 0.05 was considered statistically significant.

Conclusions: In patients with isolated complete right bundle branch blocks, systolic functions are impaired in the RV and follow-up is needed.

Key words: Bundle branch block, TIE index, right ventricular systolic dysfunction

INTRODUCTION

Right bundle branch block (RBBB) in an electrocardiogram is seen in course of interruption of the normal electrical activity in the His-Purkinje system. The normal activation sequence is changed in RBBB, resulting in appearance of a widened QRS complex and changes in the directional vectors of the R¹. The impact of a RBBB in cases with structural heart disease on cardiac function has been evaluated extensively^[2,3]. However, literature about the impact of an isolated complete RBBB without structural

heart disease on right function of the right ventricle is limited. Tissue Doppler imaging spectrum of tricuspid annular motion is closely correlated with right ventricular (RV) systolic function and has been evaluated priorly in the assessment of right ventricular function^[4]. In this background this current study was carried out to assess right ventricular function in patients with complete RBBB in normal structural heart patients admitted to the department of cardiology of a tertiary care centre in central India.

MATERIALS AND METHODS

The present study was a hospital-based prospective observational study, carried out between May 2019 and November 2019 with 100 patients aged ≥ 15 years of age who had been admitted in the department of cardiology of a tertiary care hospital in central India. The study groups

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consisted of two different group of population, in which group A (case) consisted of complete RBBB with normal structural heart and group B (control) consist of normal QRS pattern and duration with normal structural heart. Both group had 60 patients each.

Inclusion Criteria

Patients with complete and incomplete RBBB with normal structural heart in the cases.

Exclusion Criteria

Patients with structural heart disease, Left bundle branch block, Intraventricular devices. The patient clinical characteristics including age, sex, smoking status, diabetes mellitus and hypertension were recorded. All the routine blood investigation, ECG and transthoracic echocardiogram (TTE) was done. TTE was focused on LVEF (Left ventricular ejection fraction) and Right Ventricular mechanical systolic and diastolic function. RV systolic function has been evaluated using several parameters, namely, RIMP, TAPSE, 2D RV FAC, tissue doppler-derived tricuspid lateral annular systolic velocity (S').

Statistical Analyses

Statistical Analyses were done using Statistical Package for Social Survey (SPSS) and STATA Data analysis and Statistical software for Windows version 17.0. The results were tabulated and graphically represented using Microsoft Office for Windows 2008. Chi square test and t test was applied to compare the same variable between the group and P value of $<.05$ was considered statistically significant.

RESULTS

The group with isolated complete right bundle branch blocks included 36 male and 24 female patients with a mean age of 35.60 ± 11.6 years. The control group included 32 male and 28 female participants with a mean age of 38.4 ± 10.26 years. The baseline characteristics of the two groups are shown in Table 1.

The two groups were also compared on the basis of hypertension, diabetes mellitus and smoking status. We did not find any significant differences between the two groups with reference to hypertension, diabetes mellitus and smoking status. The results of the presence of co-morbidities in between the two groups have been shown in Table 2.

Compared with the control group, the RBBB group showed a prolonged QRS interval ($p <.05$). All parameters including the RV basal internal diameter, RA area, TAPSE, RIMP, S'

tissue doppler velocity at tricuspid annulus, RV FAC and E/A ratio area showed statistically significant differences as compared to control ($p <.05$). Furthermore, compared with the control group, the RBBB group had a significantly decreased peak systolic velocity ($p <.05$). On comparison of both the groups with reference to RIMP/Tei index at lateral tricuspid annulus in the RBB group was significantly increased ($p <.05$). On comparison of the left ventricular ejection fraction between the two groups we did not find a significant difference. The results of the various echocardiography parameters between the two groups have been shown in Table 3.

DISCUSSION

In our study we found that there was statistically significant difference in the TAPSE, RIMP and S' at lateral tricuspid annulus between patients with complete right bundle branch

Table 1: Baseline characteristics of two groups

Parameters	Group A (Patients with RBBB) Case (n= 60)	Group B (Patients with normal QRS dur.) control (n =60)
Age (years)	35.60	38.40
Sex	36 /24	32/28
QRS dur (msec)	125.78	95.40
S' Velo	14.20	13.48
RV FAC %	38.92	41.80
TAPSE	16.82	20.22
RIMP	0.381	0.467
E/A	0.88	1.5
LVEF	57.64	62.48

Table 2: Comparison of co-morbidities between two groups

Parameters	Grp A Case (n= 60)	Grp B Control (n =60)	Chi Square	P value
Hypertension	15 (25 %)	12 (20 %)	0.23	0.72
Diabetes Mellitus	10 (16 %)	12 (20 %)	0.10	0.76
Smoker	8 (18 %)	10 (16 %)	0.42	0.60

Table 3: Comparison of characteristics between the two groups

Parameters	Group A case (n= 50)	Group B Control (n =50)	T value	P value
QRS dur (msec)	125.78	95.50	16.20	<0.01
RA area	16.40	14.96	3.49	<0.01
RV basal diameter	39.26	34.78	4.69	<0.01
S' Velo	14.20	13.48	-4.47	<0.01
RV FAC %	38.92	41.80	-5.47	<0.01
TAPSE	16.82	20.22	-4.78	<0.01
RIMP	0.381	0.467	15.71	<0.01
E/A	0.88	1.5	-7.04	<0.01
LVEF	57.64	62.48	-1.60	0.06

blocks and the control group. In the patients with complete right bundle branch blocks, the peak systolic velocity of the movement toward the cardiac apex, were decreased. The findings of this study were consistent with those in the literature^[5]. Our results could potentially be explained mechanistically with the reasoning that because of the complete right bundle branch block, the electrical activity is not simultaneous in the left ventricle and right ventricle, and the mechanical contractions are asynchronized. Furthermore, due to the slow electrical depolarization in the right ventricle, resulting in asynchronous myocardial contraction, the local systolic velocities of the RV wall (peak systolic velocity, and peak early diastolic velocity/late diastolic velocity ratio) and time interval parameters (electromechanical delay time, isovolumic relaxation time, pre-ejection period, ejection time, and pre ejection period/ejection time ratio) are also affected. As a result, there is impairment of the systolic and diastolic functions of the right ventricle decline^[6].

Our study also showed that the Tei index at the tricuspid lateral tissue annulus was significantly increased in patients with RBBB. The Tei index, also known as the myocardial performance index is an echocardiographic parameter of cardiac function. This parameter has been used as a reliable parameter and becomes more important when it is considered that it is affected by both diastolic and systolic function in a manner directly proportional to the isovolumetric contraction time and isovolumic relaxation time and is inversely proportional to the ejection time^[7].

CONCLUSION

Our study provides important clinical implications in patients with right bundle branch blocks with a normal structural heart who on detailed echocardiographic assessment were found have abnormal RV systolic function compared with healthy individuals. Therefore, regular clinical follow-up for these patients may be needed.

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