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Original Research Article

Evaluation of right ventricular function in patients with complete right bundle branch block with normal structural heart

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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 isolated complete RBBB without structural heart disease on cardiac function of the right ventricle is limited.
Aim: To assess right ventricular function in patients with complete RBBB in normal structural heart patients
Material and Methods: Hospital based observational study in 100 patients aged ≥ 18 years. Cases (50) consisted of patients with isolated complete right bundle branch blocks without structural heart disease while the control group consisted of 50 healthy adults. The diameter, end-diastolic area, 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 diastolic function .
Results: Although, the measurements of RA area, RV basal dimension, RV fractional area change, 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 ≤ .05 was considered statistically significant.
Conclusions: In patients with isolated complete right bundle branch blocks, systolic and diastolic functions are impaired in the RV and follow-up is needed.
Keywords: Bundle branch block, normal cardiac functions, right ventricular dysfunction.

1. Introduction

Right bundle branch block (RBBB) in an electrocardiogram (ECG) 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 R and S waves [1]. 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 cardiac function of the right ventricle is limited. Tissue Doppler imaging spectrum of tricuspid annular motion is closely correlated with right ventricular (RV) systolic and diastolic 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 north eastern India.

2. Materials and Methods

The present study was a hospital-based prospective observational study, carried out between May 2015 and November 2016 with 100 patients aged ≥18 years of age who had been admitted in the department of cardiology of a tertiary care hospital in north eastern state of Meghalaya. The study groups 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 50 patients each .

2.1 Inclusion Criteria

Patients with complete RBBB with normal structural heart in the cases

2.2 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') . RV diastolic function was assessed by E/A ratio measured on pulse wave tissue doppler applied on tricupid inflow velocity.

2.3 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.

3. Results

The group with isolated complete right bundle branch blocks included 30 male and 20 female patients with a mean age of 39.80 ± 12.1 years. The control group included 28 male and 22 female participants with a mean age of 41.82 ± 12.16 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, peak early diastolic velocity, and peak early diastolic velocity/late diastolic velocity ratio (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.

Table 1: Baseline characteristics of two groups

Parameters	Group A (Patients with RBBB) Case (n= 50)	Group B (Patients with normal QRS dur.) control (n =50)
Age (years)	39.8	41.82
Sex	30 /20	28/22
QRS dur (msec)	134.28	92.20
RA area	16.40	14.96
RV basal diam	39.26	34.78
S' Velo	12.20	14.88
RV FAC %	41.92	45.40
TAPSE	18.52	22.26
RIMP	0.411	0.267
E/A	0.78	1.3
LVEF	58.96	59.88

Table 2: Comparison of co-morbidities between two groups

Parameters	Grp A Case (n= 50)	Grp B Control (n =50)	Chi Square	P value
Hypertension	12 (24 %)	10 (20 %)	0.23	0.62
Diabetes Mellitus	6 (12 %)	7 (14 %)	0.08	0.76
Smoker	8 (16 %)	10 (20 %)	0.27	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)	134.28	92.20	18.70	<0.01
RA area	16.40	14.96	4.29	<0.01
RV basal diameter	39.26	34.78	5.69	<0.01
S' Velo	12.20	14.88	-7.47	<0.01
RV FAC %	41.92	45.40	-4.47	<0.01
TAPSE	18.52	22.26	-6.78	<0.01
RIMP	0.411	0.267	14.81	<0.01
E/A	0.78	1.3	-9.04	<0.01
LVEF	58.96	59.88	-1.49	0.06

4. Discussion

In our study we found that there was statistically significant difference in the RA area, RV basal dimension, RV fractional area change, TAPSE, RIMP and S ' at lateral tricuspid annulus between patients with complete right bundle branch 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, peak early diastolic velocity of the movement away from the apex, and peak early diastolic velocity/late diastolic velocity ratio 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 and diastolic velocities of the RV wall (peak systolic velocity, peak early diastolic 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 [7,8]

5. Conclusion

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

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