

Clinical and Angiographic Correlation of Chest Pain with Right Bundle Branch Block

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Abstract

Background and Objectives: Prognostic value of incidentally discovered RBBB has important implications for cardiovascular risk assessment. This research intended to describe the prevalence and severity of CAD in patients presenting with chest pain and RBBB by correlating clinical and angiographic findings. **Methodology:** This one cross-sectional study was conducted in the Department of Cardiology of a tertiary care centre in North Karnataka from January 2012 to December 2012. A total of 50 patients presenting with chest pain and RBBB (both complete and incomplete) on ECG were included. The patients underwent chest X-ray, ECG and 2D echocardiography. Coronary angiography was done in the eligible patients and the findings with regard to LAD, ramus, LCX, OM and RCA were noted. **Results:** Majority of the patients were males (88%) and the commonest age group was more than 60 years (48%). History of hypertension, diabetes and hyperlipidemia were noted in 56%, 36% and 26% respectively. Personal history of smoking was reported by 52% while tobacco chewing and alcohol consumption was reported by 22% and 30%. Myocardial infarction was noted 48% of the patients and anterior wall MI was present in 62.5%. Abnormal coronary angiographic findings were noted in 82% and 48% of the patients had multivessel disease with involvement of proximal LAD (54%). Statistically significant association was found between coronary artery disease and male sex, age more than 60 years, comorbid conditions, habits, hypertriglyceridemia, low HDL, troponin I. **Conclusion and interpretation:** There is high rate of CAD in patients presenting with chest pain and RBBB. Angiography may be recommended among these patients to rule out the presence of CAD so as to advocate the effective management strategy.

Keywords: Aoronary Artery Disease, Coronary Angiography, Right Bundle Branch Block

1. Introduction

Coronary Heart Disease (CHD) is the leading cause of death in India and the leading cause of death worldwide. Previously thought to affect primarily high-income countries, CHD now leads to more death and disability in low- and middle-income countries, such as India, with rates that are increasing disproportionately compared to high-income countries. CHD affects people at younger ages in low- and middle-income countries, compared to high-income countries, thereby having a greater economic impact on low- and middle-income countries¹. In 2004, World Health Organisation reported that, CHD was the leading cause of death worldwide, leading to 7.2

million deaths (12.2% out of a total of 58.8 million deaths) 134.0 deaths per 100,000, 138.6 age-standardized deaths per 100,000, 22,370,000 DALYs (disability adjusted life-year) and 222,762 age-adjusted DALYs per 100,000. In the same year, CHD was the leading cause of death in India, leading to 1.46 million deaths (14% out of a total of 10.3 million deaths), 130.7 deaths per 100,000, 207.7 age-standardized deaths per 100,000, 15,588,000 DALYs and 1,931 age-adjusted DALYs per 100,000^{2,3}. No prospective national cohort registries of CHD in India has published CHD incidence rates CHD prevalence rates can be estimated from several studies over the past several decades in either rural or urban cohorts, as shown in the above atlas. Unadjusted CHD

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rates have ranged from 1.6% to 7.4% in rural populations and 1% to 13.2% in urban populations.⁴ In 2000, there were an estimated 29.8 million people with CHD in India, out of a total estimated population of 1.03 billion people, or a nearly 3% overall prevalence⁴.

Coronary Heart Disease (CHD) occurs when the arteries of the heart that normally provide blood and oxygen to the heart are narrowed or even completely blocked. Angina is exertional chest pain, pressure, or discomfort caused by such narrowings or blockages in the heart arteries, which reduce the flow of blood. Acute Coronary Syndromes (ACS), otherwise known as heart attacks, occur when a blockage occurs suddenly. Symptoms of a heart attack include: pain or discomfort in the middle of the chest, arms/shoulders/elbows (classically on the left side), jaw, or back. In addition the person may feel shortness of breath, nausea/vomiting, light-headedness/faint/pale, or may break into a cold sweat. Women are more likely to have shortness of breath, nausea, vomiting, and back or jaw pain³. Coronary Artery Disease (CAD) is the leading causes of heart failure and death worldwide. Acute cardiac events that may lead to acute Myocardial Infarction (AMI) and sudden cardiac death are unpredictable. Conduction disturbances, like Right Bundle Branch Block (RBBB) or Left Bundle Branch Block (LBBB) may be considered as a predictor of severity of CAD and coronary events. Previous studies revealed the impact of intra-ventricular conduction disturbances on survival of patients with AMI and patients with chronic CAD⁵.

The right bundle branch is a long, thin, and discrete structure composed of high-velocity conduction Purkinje fibres. It is located in the right side of the interventricular septum and occupies a subendocardial position in its superior and inferior thirds and deeper in the middle third. There are no ramifications in most of its course, but it starts to branch as it reaches the base of the anterior papillary muscle. The appearance of a right bundle branch block (RBBB) alters the ventricular activation sequence, produces a QRS prolongation, and changes the orientation for R- and S-wave vectors, thus generating a typical Electrocardiogram (ECG) pattern. Right bundle branch block is generally considered a benign finding that does not imply increased risk when found in asymptomatic healthy individuals⁶. Older estimates have reported the prevalence of RBBB in the general population between 0.2% and 0.8%¹ however, recent studies have reported overall rate of RBBB upto 10.1%⁷.

The prevalence of RBBB is known to increase with age, to be higher in men, diabetics, and in patients with hypertension.⁶ Right bundle branch block may also indicate affection of the right side of the heart through cor pulmonale, myocardial ischaemia/infarction, pulmonary embolism, myocarditis, or congenital heart disease. It may be associated with different cardiac structural diseases such as ischaemic heart disease, myocarditis, hypertension, congenital heart disease, cor pulmonale, and pulmonary embolism⁶.

Evidently, the prognostic value of incidentally discovered RBBB has important implications for cardiovascular risk assessment. Further the prognosis of RBBB depends on the type and severity of the associated heart condition; for example, in patients with ischaemic heart disease the presence of RBBB is a well-established mortality predictor. The same is true for patients with heart failure where at least two different studies showed a worse prognosis for patients with RBBB hospitalized with this condition⁸.

There are few studies that compared the relationship of Bundle Branch Block and severity of CAD in patients with suspected CAD and its impact on survival of patients. Most of these studies have been done in patients with left anterior hemi-block and LBBB. However, few studies have been done regarding the relation between RBBB and severity of coronary artery disease. This research was intended to describe the prevalence and severity of CAD in patients presenting with chest pain and RBBB by correlating clinical and angiographic findings.

2. Methodology

This one cross-sectional study was conducted in the Department of Cardiology of a tertiary care centre in North Karnataka from January 2012 to December 2012. Prior to the commencement of the study, ethical clearance was obtained from Human Ethics Committee. A total of 50 patients presenting with chest pain and RBBB (both complete and incomplete) on ECG were included in the study. Patients presenting RBBB and chest pain with congenital and rheumatic heart diseases were excluded from the study. RBBB was defined using standard electrocardiographic (ECG) criteria⁹ as 1) a QRS duration ≥ 120 msec, 2) the presence of an rSR' pattern of QRS in lead V1, 3) a PQ interval > 120 msec, and 4) a S wave in lead I and either lead V5 or V6. RBBB was further classified

Patients were interviewed and demographic data such as age, sex, occupation and the presenting symptoms such as angina, breathlessness, palpitation, syncope and fatigue were noted. These patients were evaluated for the presence of risk factors such as hypertension, diabetes, obesity, family history, hyperlipidemia, habits (smoking, alcohol and tobacco chewing). Thorough clinical examination was done to evaluate the vitals and clinical signs and the findings were recorded on a predesigned and pre-tested proforma. The patients were subjected for routine blood investigations including complete blood count, blood urea nitrogen, serum creatinine, fasting lipid profile and cardiac enzymes. The patients underwent chest X-ray, ECG and 2D echocardiography. ECG was done on 12 lead surface ECG machine. Coronary angiography was done in the eligible patients and the findings with regard to LAD, ramus, LCX, OM and RCA were noted. Based on the final diagnosis patients were advised with management and the outcome was recorded.

3. Statistical Analysis

The categorical data was expressed as rates, ratios and percentages and comparison was done using chi-square test. Continuous data was expressed as mean $\pm$ standard deviation. Categorical data was analysed with chi-square test and a 'p' value of less than or equal to 0.05 was considered as statistically significant.

4. Results

Of the 50 patients, 41 patients (82%) had abnormal coronary angiographic findings (Figure 1) and among 48% of the patients multivessel disease was noted (Figure 2) and most of the patients (54%) had involvement of proximal LAD (Figure 3). Majority of the patients were males (88%) and the commonest age group was more than 60 years comprised of 48% patients (Table 1). The association of age and sex is as shown in table 1. It was observed that the coronary artery disease was significantly high among males ($p=0.001$) and in those who were aged more than 60 years. With regard to type of angina, 48% of the patients had myocardial infarction and 38% had unstable angina. Of the 24 patients with myocardial infarction, anterior wall MI was noted in 62.5%, inferior wall MI in 29.16% and posterior wall MI in 8.33%. However, no statistically significant difference was noted with coronary artery disease and type of angina (Table 2).

The history of other comorbid conditions such as hypertension, diabetes and hyperlipidemia were noted in 56%, 36% and 26% respectively. However no statistically significant association was found between the presence of these comorbid conditions and coronary artery disease (Table 3).

The history of smoking was reported by 52% of the patients while tobacco chewing and alcohol consumption was reported by 22% and 30% respectively but no statistically significant association was found between habits and the presence of coronary artery disease (Table 4).

With regard to lipid profile total cholesterol, triglycerides, high density lipoprotein and low density lipoprotein were found to be abnormal in 70%, 28%, 56% and 30% respectively. Coronary artery disease was significantly associated with the raised triglyceride levels and low HDL levels. However no association was found with raised total cholesterol and low density lipoprotein. Most of the patients had abnormal troponin I levels (64%) and showed statistically significant association with coronary artery disease (Table 5).

5. Discussion

The impact of conduction disturbances like RBBB or LBBB on morbidity and mortality and its relation to the severity of CAD has been controversial for more than three decades. Very little is known about the relation between RBBB and severity of coronary artery disease. In this study, on angiography, 82% of the patients who presented with chest pain and RBBB had coronary artery disease. Almost half of the study population (48%) was detected with single vessel disease while double vessel and multi vessel disease was noted in 20% and 14% respectively. Most of the patients (54%) had involvement of proximal LAD. Studies showing significance between the chest pain in context with RBBB and angiographic findings are scarce. However, recently, a study⁹ from Japan revealed 10.1% prevalence of RBBB that is, 145 in 1120 patients admitted at Iwakuni Clinical Centre, Japan from 1997 to 2006 with acute anterior or inferior myocardial infarction within 48 hours of onset. Of the 145 patients with RBBB, 94 (64.82%) patients arrived with chest pain within 6 hours of onset. Coronary arteriograms on admission demonstrated 1 or 2 segment of the right coronary artery was culprit lesion in 30 (73.2%) of 41 patients with new permanent RBBB and in 36 (69.2%) of 52 patients

Arslan U et al¹⁰ in 2008 investigated functional status of patients (Killip class), left ventricular contractility, angiographic anatomy and severity of coronary lesions in patients with and without Right Bundle Branch Block (RBBB) in the setting of anterior Myocardial Infarction (MI). Patients who admitted to coronary care unit with the diagnosis of acute anterior MI between 1999 and 2005 were retrospectively searched from database. Out of 792 patients, 37 had RBBB (RBBB group) either at admission or in the course of anterior MI. Forty patients who developed no intraventricular conduction defect during the course of anterior MI with the same demographic characteristics were selected as the control group. Out of 37 patients, 30 had RBBB on admission and 7 developed RBBB in the course of acute MI. Left Anterior Descending artery (LAD) proximal lesion was more commonly detected in the RBBB group [23 (62.2%) vs. 11 (27.5%) patients, $p=0.003$]. The authors commented that, culprit lesion in patients with RBBB is more commonly a LAD proximal lesion and threatened myocardial tissue is larger in patients with RBBB. The findings of this study were in agreement with the study by Arslan U et al¹⁰ as proximal LAD was the predominant lesion detected in our study. However, few other studies have showed no relation between RBBB and CAD. A similar study by Haft et al.,¹¹ during 1984 on 5,132 consecutive patients who had coronary arteriography for chest pain, 103 (2%) had Right Bundle Branch Block (RBBB), 66 (64%) of whom had no electrocardiographic evidence of concomitant myocardial infarction (MI); 23 patients had evidence of MI of the inferior wall, 8 of the anterior wall and 6 of the lateral wall. The incidence, location or severity of CAD in patients with RBBB alone was not significantly different from those in 110 similarly symptomatic patients with normal ECGs. Similarly, patients with RBBB and inferior MI, compared with 60 similarly symptomatic patients with inferior MI without RBBB, showed no significant differences in location, incidence or severity of CAD. Hence the authors concluded that, the presence of RBBB does not suggest more severe or extensive CAD. Kręcki et al.,¹² also reported that in patients with severe chronic CAD, RBBB and LBBB had no significant impact on patient's mortality independent of other risk factors, i.e. old age, history of DM, anemia, low LVEF and chronic renal failure. In the present study males (88%) outnumbered females (12%) with male to female ratio of 7.3:1. The rate of coronary artery disease was significantly high

($p=0.001$) among males (88.64%) compared to females (33.33%). Similarly, all the patients (100%) who presented with age more than 60 years and maximum patients who were aged between 45 to 60 years had coronary artery disease (68.42%) compared to 60% and 50% of the patients who were aged between 31 to 45 years and less than 30 years ($p=0.014$). Data on sex and age predilection in patients presenting with chest pain and RBBB having CAD is lacking. However, recent research suggests that, the prevalence of RBBB is approximately twice as high in men as in women and was highly age-dependent ranging from 0.6% in women below the age of 40 to 14.3% in men above the age of 80. Previous studies have shown varying results, most likely due to differences in age distribution and population characteristics, including lack of exclusion of participants with existing heart disease⁶. A Swedish study of 855 men from the general population reported a comparable cumulative incidence ranging from 1% at age 50 to 13% at age 80⁷. In the Reykjavik study, which included 18,762 individuals, the prevalence of RBBB was somewhat lower increasing from 0% at the age of 30 to 4.1% in men and 1.6% in women between 75 and 79 years of age¹³. Other studies have also reported a prevalence that was twice as high in men compared with women.¹³⁻¹⁵ In the present study we did not find any association between risk factors such as hypertension, dyslipidemia and diabetes. Recent studies have shown that, in addition to increasing age and male gender, prevalent and incident RBBBs were associated with higher blood pressure but not consistently with other cardiovascular risk factors. Similar results have been reported in other studies^{13,14}. This may indicate that RBBB when seen in patients free from CVDs should not be regarded as a marker of the cumulative effect of traditional cardiovascular risk factors causing CHD but as a marker of progressive degenerative disease, as indicated through the associations with increasing age and hypertension. The higher prevalence of RBBB in men compared with women was not caused by differences in risk factor distribution and remains largely unexplained⁶. Several other studies have focused the link between RBBB and coronary artery disease. Freedman et al.,¹⁶ conducted a study on 15609 patients with chronic CAD and they found that patients who had BBB also had more severe CAD, lower LVEF, and higher two-year mortality. Cortigiani et al.¹⁷ revealed that the presence of RBBB with left anterior hemi-block (LAHB) was a strong risk factor for mortality in patients with established CAD.

Table 1. Demographic characteristics

Characteristics	Sub group	Coronary artery disease				Total (n=50)		p value
		Present (n=41)		Absent (n=9)				
		No	%	No	%	No	%	
Sex	Male	39	88.64	5	11.36	44	88.00	0.001
	Female	2	33.33	4	66.67	6	12.00	
	Total	41	82.00	9	18.00	50	100.00	
Age (Years)	30 or less	1	50.00	1	50.00	2	4.00	0.014
	31 to 45	3	60.00	2	40.00	5	10.00	
	46 to 60	13	68.42	6	31.58	19	38.00	
	> 60	24	100.00	0	0.00	24	48.00	
	Total	41	82.00	9	18.00	50	100.00	

Table 2. Association of coronary artery disease with type of angina

Angina	Coronary artery disease				Total (n=50)	
	Present (n=41)		Absent (n=9)			
	No	%	No	%	No	%
Myocardial infarction	22	91.67	2	8.33	24	48.00
Unstable angina	14	73.68	5	26.32	19	38.00
Others	5	71.43	2	28.57	7	14.00
Total	41	82.00	9	18.00	50	100.00

p=0.230

Table 3. Association of coronary artery disease with history of other comorbid conditions

Comorbid conditions	Findings	Coronary artery disease				Total (n=50)		p value
		Present (n=41)		Absent (n=9)				
		No	%	No	%	No	%	
Hypertension	Present	22	78.57	6	21.43	28	56.00	0.477
	Absent	19	86.36	3	13.64	22	44.00	
	Total	41	82.00	9	18.00	50	100.00	
Diabetes	Present	17	94.44	1	5.56	18	36.00	0.086
	Absent	24	75.00	8	25.00	32	64.00	
	Total	41	82.00	9	18.00	50	100.00	
Hyperlipidemia	Present	12	92.31	1	7.69	13	26.00	0.261
	Absent	29	78.38	8	21.62	37	74.00	
	Total	41	82.00	9	18.00	50	100.00	

Table 4. Association of coronary artery disease with habits

Habits	Findings	Coronary artery disease				Total (n=50)		p value
		Present (n=41)		Absent (n=9)				
		No	%	No	%	No	%	
Smoking	Present	23	88.46	3	11.54	26	52.00	0.216
	Absent	18	75.00	6	25.00	24	48.00	
	Total	41	82.00	9	18.00	50	100.00	
Tobacco chewing	Present	9	81.82	2	18.18	11	22.00	0.986
	Absent	32	82.05	7	17.95	39	78.00	
	Total	41	82.00	9	18.00	50	100.00	
Alcohol consumption	Present	12	80.00	3	20.00	15	30.00	0.810
	Absent	29	82.86	6	17.14	35	70.00	
	Total	41	82.00	9	18.00	50	100.00	

Table 5. Association of coronary artery disease with dyslipidemia and cardiac enzymes

Variables	Findings	Coronary artery disease				Total (n=50)		p value
		Present (n=41)		Absent (n=9)		No	%	
		No	%	No	%			
Total	Normal	14	93.33	1	6.67	15	30.00	0.172
Cholesterol	Abnormal	27	77.14	8	22.86	35	70.00	
	Total	41	82.00	9	18.00	50	100.00	
Triglycerides	Normal	27	75.00	9	25.00	36	72.00	0.039
	Abnormal	14	100.00	0	0.00	14	28.00	
	Total	41	82.00	9	18.00	50	100.00	
HDL	Normal	15	68.18	7	31.82	22	44.00	0.024
	Abnormal	26	92.86	2	7.14	28	56.00	
	Total	41	82.00	9	18.00	50	100.00	
LDL	Normal	28	80.00	7	20.00	35	70.00	0.574
	Abnormal	13	86.67	2	13.33	15	30.00	
	Total	41	82.00	9	18.00	50	100.00	
Troponin I	Normal	12	66.67	6	33.33	18	36.00	0.034
	Abnormal	29	90.63	3	9.38	32	64.00	
	Total	41	82.00	9	18.00	50	100.00	

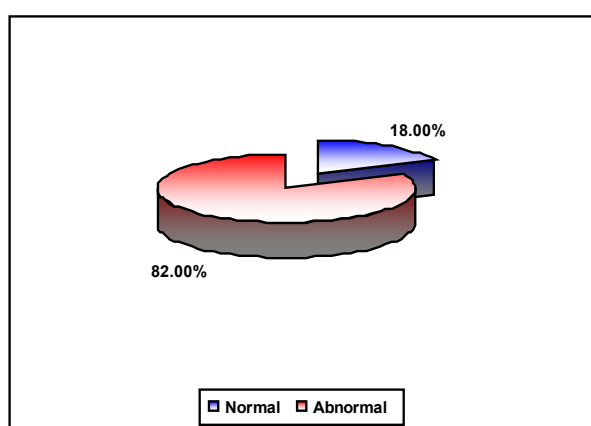


Figure 1. Coronary artery disease in patients with RBBB.

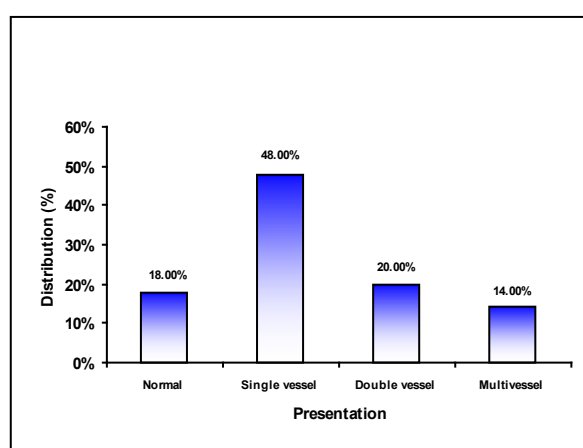


Figure 2. Angiographic findings.

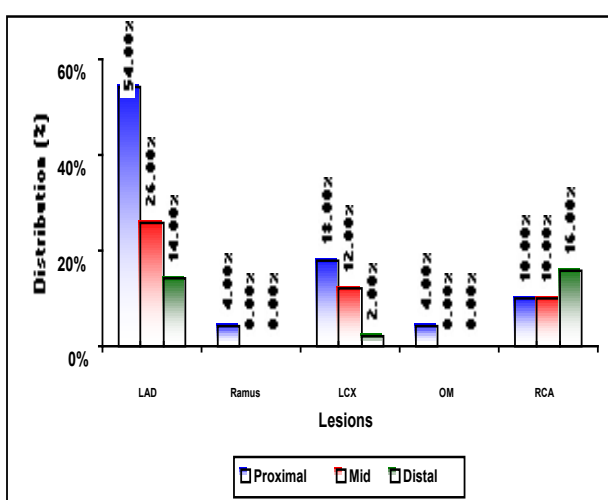


Figure 3. Lesions.

In addition, Go AS et al¹⁸ studied 297832 patients with AMI and they suggested RBBB as the strongest risk factor for in-hospital mortality. In their cases 6.7% (n=19967) of the patients had LBBB and 6.2% (n=18354) had RBBB. The in hospital mortality among the patients with LBBB was 34% (OR=1.34, 95%CI: 1.78-1.39), and in patients with RBBB it was 64% (OR=1.64, 95% CI: 1.57-1.71). Ricou et al.¹⁹ also conducted a study in 1991 on 932 patients with AMI and RBBB (n=178). They reported not only a higher left ventricular failure but also a higher in-hospital and one year mortality compared to those without RBBB. These findings showed that RBBB after AMI could be considered as an independent factor for poor prognosis. However, in the present study though mortality was not taken into the consideration as it was beyond the scope of the study, surprisingly no mortality was observed which could be attributable to the consequent interdisciplinary approach, to include specialized cardiologic care and expertise with close monitoring of patients which are prerequisite for successful management.

The limitation of the study was that the patients were assessed for outcome at the time of discharge and no further follow up was considered as it was beyond the scope of this study. The other limitation was the smaller sample size resulting in male preponderance and maximum number of patient from age group of more than 45 years which would have biased the study results. Further studies on large sample, sex and age standardized study population including long term follow up would emphasize the close relationship in patients presenting with chest pain, RBBB and coronary artery disease.

6. Conclusion

Overall, the present study showed high rate of CAD in patients presenting with chest pain and RBBB. Hence angiography may be recommended among these patients to rule out the presence of CAD so as to advocate the effective management strategy.

7. References

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