Section: Cardiology

Original Research Article

A STUDY ON THE PROGNOSTIC SIGNIFICANCE OF RIGHT BUNDLE BRANCH BLOCK IN ACUTE MYOCARDIAL INFARCTION

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Abstract

Background: Coronary artery disease (CAD) is an important cause of death and disability in developing countries like India. The present study was designed to find out the outcome of patients with right bundle branch block (RBBB) in acute myocardial infarction. This could help to prognosticate the patients and determine the mortality and morbidity associated with right bundle branch block in acute myocardial infarction. **Materials and Methods:** A cohort study was conducted among 108 patients admitted with acute myocardial infarction in a tertiary centre in middle Kerala, India, during a one-year period. The patients were classified into four groups according to the type of RBBB, and the outcomes were compared. The data was entered in Excel and analysed using EPI Info software. **Result:** In the new as well as age-indeterminate RBBB groups, most of the patients belonged to the age range of 41 to 50 years (40.7%), whereas in the old RBBB group, it was 61 to 70 years (44.4%), and in the absent RBBB group, it was 51 to 60 years. The gender distribution showed male predominance in all the RBBB groups except for pre-existing RBBB. Among the comorbidities, smoking was the highest in the age-indeterminate RBBB group (63%), followed by diabetes and hypertension (both 48.1%), and renal disease was the highest in the new RBBB group (29.6%). Right heart failure was more common in the old RBBB group (33.3%), whereas arrhythmias in the age-indeterminate group (37%). The maximum mortality was in the old RBBB group (22.2%) and the lowest in patients without RBBB. **Conclusion:** The complications were significantly higher in patients with RBBB than in patients without RBBB. Right heart failure was highest in the old RBBB group. Smoking and diabetes were the most common comorbid conditions. The mortality was highest in the old RBBB group.

INTRODUCTION

Coronary artery disease (CAD) is described as one of the leading causes of mortality and morbidity throughout the world. The Asian population remains at higher risk, mostly because of ethnic reasons. In India, which is the second-most populous country in the world, nearly one-third of adult deaths have been attributed to coronary artery diseases in recent years. The most common form of coronary artery disease is myocardial infarction. The World Health Organization estimates that CAD mortality will be on the rise in the coming years, and around 23.6 million people will die of this malady by 2030.

Acute myocardial infarction (AMI) occurs when sudden blockade of the coronary artery stops blood perfusion to the myocardium. Most AMIs are caused by coronary artery disease, in which the rupture of an unstable atherosclerotic plaque plays an importance role. The prevalence of myocardial infarction is higher in men in all age-specific groups than women. The modifiable factors such as smoking, hypertension, dyslipidemia, diabetes mellitus, obesity, alcohol consumption, and physical inactivity represent over 90% of the risk for acute MI.

Right bundle branch block (RBBB) appeared to be an independent risk factor in patients with acute anterior myocardial infarction. Considering the

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anatomy and vascular supply of the conduction system, RBBB is usually the manifestation of large anterior MI that are often accompanied by heart failure and atrio-ventricular (AV) conduction block,[1,2] but the mechanism by which it represents an independent risk factor is still unclear. Furthermore, RBBB appears not only in patients with anterior myocardial infarction but is also observed frequently in acute MI of other locations, especially of the left ventricular inferior wall.[3,4] As a defect in the cardiac conduction system, the right bundle branch block (RBBB) is determined when an electrocardiogram (ECG) shows a notched R wave typically displayed as an M-shaped rSR' complex and secondary ST-T change in lead V_1 and slurred S wave in lead I and V_6 along with right axis deviation. QRS duration exceeding 120 milliseconds indicates complete RBBB. The Right bundle branch itself is more vulnerable to damage due to its anatomic nature as a superficial branch with limited blood perfusion compared with the left bundle branch (LBB). Epidemiologically, the prevalence of RBBB increases in the elderly population.[5,6] RBBB is basically considered a benign ECG finding without accompanying disease, especially in healthy young adults.[7] However, in other cases, it may also be associated with underlying lung and heart pathologies, such as cor pulmonale, pulmonary embolism, ischemic heart disease, rheumatic and congenital heart disease, myocarditis, and degenerative diseases of the cardiac conduction system.[8]

Since the pre-thrombolytic era, observational studies have been conducted to investigate the association between RBBB and the prognosis of AMI, but the results remain uncertain. Some studies showed RBBB was associated with larger infarct size, heart failure, ventricular arrhythmias, death, and poorer outcomes,[9,10] while others did not find any significant prognostic value.[11-13] Since there are not many studies conducted in our part of the country on this, our study is an attempt to elucidate the prognostic significance of right bundle branch block in acute myocardial infarction among patients attending Government Medical College hospital, Thrissur, which is a major tertiary care center in the central part of Kerala state. To the best of our knowledge this is the first comparative study in our state on this subject and will immensely contribute to our knowledge in the study of coronary artery disease and bundle branch blocks.

MATERIALS AND METHODS

All the patients attending the casualty service and admitted to the ICU or medical wards (Department of General Medicine, Government Medical College, Thrissur) with features of acute coronary syndrome on clinical, ECG, and biochemical grounds during a one-year period were considered for our study. Both ST segment elevation myocardial infarction and Non-ST segment elevation myocardial infarction were included. Patients with known ventricular dysfunction, left bundle branch block, arrhythmias, AV block, valvular heart diseases, and major systemic illnesses like malignancy were excluded. Detailed clinical examination was done in all patients who were followed up inside the hospital and the outcome was analyzed especially in the context of right bundle branch block. The study was carried out after getting clearance from the institutional review board and also with due consent taken from the patient or relative.

RESULTS

The study was conducted among patients attending medical casualty services, who were diagnosed with acute coronary syndrome. Both ST segment elevation myocardial infarction and non-ST segment elevation myocardial infarction were included in the study. A detailed clinical examination was done in all patients and the patients were followed up in the hospital to study the outcome of acute myocardial infarction to compare the outcome in patients with new RBBB, old RBBB, age-indeterminate RBBB and absent RBBB. 27 patients in each of the four groups, for a total of 108, were included in the study.

Age Distribution

The patients were divided into RBBB groups and age groups. In the new RBBB group most of the patients were in the age group 41 to 50 years (40.7%), in the old RBBB group highest patients were in the age group 61 to 70 years (44.4%), in the absent RBBB group, 51 to 60 years were the most common; and in the age-indeterminate RBBB group, the highest patients were in age group 41 to 50 years (51.9%). The mean age was similar in the new RBBB, old RBBB and absent RBBB, but lower in the age-indeterminate RBBB group; this was statistically significant. [Figure 1]

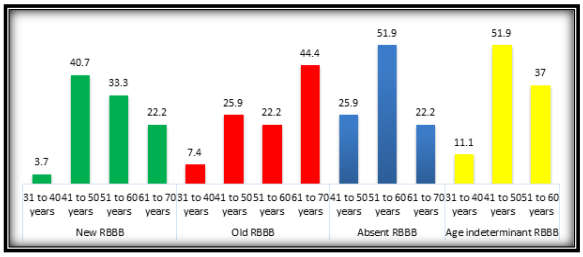

Figure 1: Types of RBBB and age groups

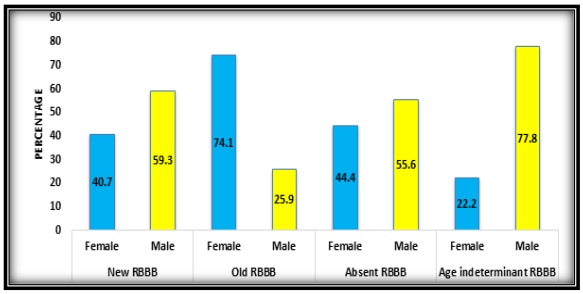

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Figure 2: Types of RBBB and gender distribution

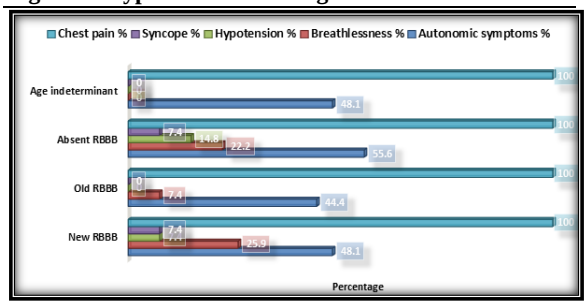

Figure 3: Types of RBBB and symptoms (%)

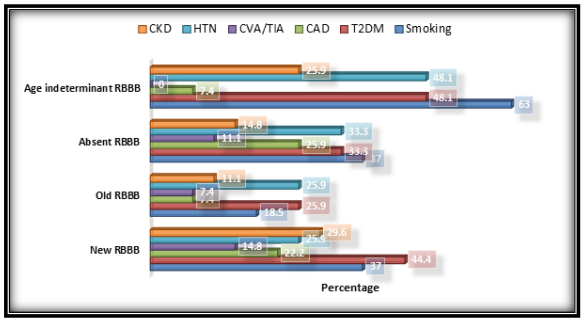

Figure 4: Types of RBBB and comorbidities (%)

Gender Distribution

The gender distribution showed that the new RBBB group had more males (59.3%), the old RBBB group had female predominance (74.1%), the absent RBBB group had more male patients (55.6%) and in the age-indeterminate RBBB group also, males were more prevalent (77.8%). [Figure 2]

Presenting Symptoms

Chest pain was the presenting symptom for patients in all four groups. Autonomic symptoms were higher in the absent RBBB group (55.6%), breathlessness was highest in the new RBBB group (25.9%), hypotension highest in the absent RBBB group (14.8%), and syncope was a major complaint in both new and absent RBBB groups (7.4%). [Figure 3]

Comorbidities

The comorbidities in patients showed smoking was highest in the age-indeterminate RBBB group (63%), as was type 2 diabetes mellitus (48.1%). Past coronary events were highest in the absent RBBB group (22.2%), stroke or TIA in the new RBBB group (14.8%), hypertension in the age-indeterminate RBBB group (48.1%) and chronic kidney disease in the new RBBB group (29.6%). [Figure 4]

General Examination

Examination of patients revealed pallor was most common in the new RBBB group (29.6%), pedal edema was highest in both new and absent RBBB groups (22.2%), cyanosis was highest in both new and age-indeterminate RBBB groups (7.4%), clubbing was mainly in the age-indeterminate group (40.7%), and elevated JVP was highest in the new RBBB group (25.9%). [Table 1]

Blood Investigations

The blood investigations showed similar hemoglobin levels in the new RBBB, old RBBB, and absent RBBB groups, but slightly higher in the age-indeterminate group. The total WBC count was similar across all four groups. Troponin I was highest in the new RBBB and lowest in the age-indeterminate group, though all the groups were showing high Troponin values. [Table 2]

Complications

Among the complications observed in patients, acute pulmonary edema was highest in the age-indeterminate RBBB group (18.5%), right heart failure was highest in the old RBBB group (33.3%), arrhythmias were common in the age-indeterminate group (37%) but mortality was highest in the old RBBB group (22.2%) followed by the new RBBB group (14.8%). [Table 3]

Types of ACS

The acute coronary events in patients showed STEMI was highest in the old RBBB group (22.2%), followed by age-indeterminate RBBB (18.6%), new RBBB (11.1%) and absent RBBB (3.7%) groups. Most of the patients with NSTEMI were associated with the absent RBBB group (96.3%), followed by the new RBBB in 88.9%, the age-indeterminate RBBB in 81.5% and the old RBBB in 77.8%. [Table 4]

Table 1: Types of RBBB and examination

Type of RBBB	General examination	Pallor		Pedal Edema		Cyanosis		Clubbing		Elevated JVP	
		n	%	n	%	n	%	n	%	n	%
New RBBB	No	19	70.4	21	77.8	25	92.6	26	96.3	20	74.1
	Yes	8	29.6	6	22.2	2	7.4	1	3.7	7	25.9
Old RBBB	No	24	88.9	25	92.6	27	100.0	24	88.9	25	92.6
	Yes	3	11.1	2	7.4	0	0	3	11.1	2	7.4
Absent RBBB	No	22	81.5	21	77.8	26	96.3	25	92.6	21	77.8
	Yes	5	18.5	6	22.2	1	3.7	2	7.4	6	22.2
Age indeterminate RBBB	No	20	74.1	27	100.0	25	92.6	16	59.3	27	100.0
	Yes	7	25.9	0	0	2	7.4	11	40.7	0	0
Chi-square test; P value		0.353		0.031		0.511		0.001		0.017	

Table 2: Types of RBBB and blood investigations

Type of RBBB	Blood investigations	Haemoglobin	Total WBC count	Troponin I
		n	n	n
New RBBB	Mean	12.5	8592.6	332.0

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	Std. Deviation	1.9	2764.2	163.8
Old RBBB	Mean	12.7	8148.1	309.2
	Std. Deviation	2.1	2034.2	146.5
Absent RBBB	Mean	12.8	8692.6	260.4
	Std. Deviation	1.6	2379.9	147.2
Age indeterminate RBBB	Mean	13.6	8918.5	259.4
	Std. Deviation	2.2	3042.8	150.7

Table 3: Types of RBBB and complications

Type of RBBB	Complications	Acute Pulmonary Edema		RHF		Arrhythmias		Death	
		n	%	n	%	n	%	n	%
New RBBB	No	25	92.6	25	92.6	23	85.2	23	85.2
	Yes	2	7.4	2	7.4	4	14.8	4	14.8
Old RBBB	No	25	92.6	18	66.7	25	92.6	21	77.8
	Yes	2	7.4	9	33.3	2	7.4	6	22.2
Absent RBBB	No	25	92.6	25	92.6	25	92.6	25	92.6
	Yes	2	7.4	2	7.4	2	7.4	2	7.4
Age indeterminate RBBB	No	22	81.5	22	81.5	17	63.0	27	100.0
	Yes	5	18.5	5	18.5	10	37.0	0	00
Chi-square test; P value		0.032		0.032		0.009		0.058	

Table 4: Types of RBBB and types of ACS

Type of RBBB	STEMI		NSTEMI	
	n	%	n	%
New RBBB	3	11.1	24	88.9
Old RBBB	6	22.2	21	77.8
Absent RBBB	1	3.7	26	96.3
Age indeterminate RBBB	5	18.5	22	81.5

DISCUSSION

This study was done in acute coronary syndrome patients who were then clinically examined and divided into new RBBB, old RBBB, absent RBBB, and age indeterminate RBBB groups to identify the clinical profile and outcome. The gender distribution showed that RBBB predominantly occurred in males with mean age of 56 years. The reviewed studies by M. N. Islam et al,[14] showed the mean age of the patients was 53 years with male-female ratio 2.6:1. According to all the previous studies, the patients with RBBB were elderly males when compared with patients without any bundle branch block.[15-17]

Among the comorbidities noted in our study, smoking was highest in age indeterminate RBBB group (63%), and also diabetes mellitus (48.1%), previous CAD occurrence highest in absent RBBB group (22.2%), history of cerebrovascular events highest in new RBB group (14.8%), hypertension highest in age indeterminate RBBB group (48.1%) and maximum association with chronic kidney disease was observed in new RBBB group (29.6%). Mayra et.al. reported that in the presence of RBBB, patients with AMI had more co-morbidities and had a higher mortality risk.[18] There were more patients with past medical history of diabetes mellitus or hypertension who presented with acute MI.[15,17,19] These studies reported that there was no significant difference in the comorbidity of diabetes mellitus or hypertension between those with and without RBBB. Conversely, Antonio et al,[15] even found the opposite result, indicating there was more comorbidity in patients without bundle branch block compared with those with RBBB. David et al,[19] also showed similar results.

In our study the blood investigations showed the haemoglobin levels were similar in new RBBB, old RBBB and absent RBBB and slightly higher in age indeterminate group. The total WBC count was similar across all four groups. The Troponin I was highest in new RBBB and lowest in age indeterminate RBBB. The reviewed studies also showed the peak levels of cardiac enzymes like Creatinine Kinase-MB (CK-MB), and Cardiac Troponin I (cTnI) were significantly elevated in patients with RBBB.[20]

In our study the mortality was highest in old RBBB group (22.2%) followed by new RBBB group (14.8%) and no RBBB group showed the lowest mortality. The reviewed studies by Juntao Wang et al,[21] showed that compared with previous RBBB, AMI patients with new-onset RBBB had higher risk of long-term mortality, ventricular arrhythmia, but lower risk of heart failure. J. Iwasaki et al,[22] showed in-hospital death and pulmonary congestion were observed more frequently in patients with RBBB than in those without RBBB. New permanent RBBB is a strong independent predictor for increased in-hospital mortality, regardless of the infarction location. According to Antonio Melgarejo-Moreno et al,[9] early mortality was significantly higher for new RBBB (43.1%, P<.001) than for old (15.5%) and indeterminate (15.3%) RBBB. These figures for 1-year mortality were 58.8% (P<.001), 35.5 (P<.01), and 23% (NS), respectively. Permanent and transient RBBB had different mortality rates: early mortality, 76% versus 8%, and 1-year mortality, 84% versus 32% (P<.001

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for both). According to Li Xiang et al,[23] right bundle branch block was associated with significantly increased overall mortality in patients with AMI. The OR of RBBB for deaths was 1.56 [95% confidence interval (CI), 1.44 to 1.68, p<0.001]. Right bundle branch block was associated with an increased risk of all-cause mortality and indicates a poorer prognosis in patients with AMI. F. Ricou et al,[12] observed that the presence of RBBB was an independent predictor of increased in-hospital and 1-year mortality when entered in a multivariate analysis. M. N. Islam et al,[14] showed that the complications were more frequently observed in patients with RBBB: in-hospital mortality, 27.40% vs 10.90% (P < 0.01); use of temporary pacemaker, 15% vs 9% (P < 0.05); and heart failure, 50% vs 35% (P < 0.05). In sub-group analysis, in-hospital mortality rate was higher among bi-fascicular group than isolated RBBB group (P < 0.05). There are conflicting results: Francois Ricou indicated that the occurrence of right bundle branch block in patients of AMI was an independent predictor of long-term morality.[24] Brilakis et al,[16] showed that the newly diagnosed RBBB was associated with significantly higher in-hospital mortality compared with pre-existing RBBB (33.5% vs. 5.3%), which is consistent with the result reported by H. Hod et.al. (39% vs. 8.8%).[25] C. K. Wong et al,[20] reported that the 30-days mortality in patients with newly diagnosed and pre-existing RBBB was 33% and 11.6%, respectively. Iwasaki et al,[22] observed that both in inferior and anterior wall MI, in-hospital death and pulmonary congestion occurred more frequently in new permanent RBBB patients when compared to patients with other types of right bundle branch block.

CONCLUSION

The complications are significantly higher in acute myocardial infarction patients with right bundle branch block than in those without RBBB. Among patients with RBBB, acute pulmonary edema and arrhythmias are significantly higher in the age-indeterminate RBBB group. The incidence of right heart failure is significantly higher in the old RBBB group. The mortality is very high in new as well as old RBBB groups and lowest among patients without bundle branch block. The association of risk factors like smoking, hypertension, and diabetes is highest in the age-indeterminate RBBB group, but pre-existing CVA and CKD are more commonly associated with the new RBBB group.

REFERENCES

1. Mullins CB, Atkins JM. Prognoses and management of venticular conduction blocks in acute myocardial infarction. Mod Concepts Cardiovasc Dis. 1976;45(10):129–33.
2. Hollander G, Nadiminti V, Lichstein E, Greengart A, Sanders M. Bundle branch block in acute myocardial infarction. Am Heart J. 1983;105(5):738–43.
3. Hod H, Goldbourt U, Behar S. Bundle branch block in acute Q wave inferior wall myocardial infarction: A high risk subgroup of inferior myocardial infarction patients. Eur Heart J. 1995;16(4):471–7.
4. Okabe M, Nomoto J, Fukuda K, Arakawa K, Kikuchi M. Right bundle branch block in a patient with acute posterior myocardial infarction. Jpn Circ J. 1997;61(1):78–81.
5. Tomoda H, Aoki N. Right bundle branch block in acute myocardial infarction treated by primary coronary angioplasty and stenting. Angiology. 2005;56(2):131–6.
6. Viswanathan K, Kilcullen N, Morrell C, Thistlethwaite SJ, Sivananthan MU, Hassan TB, et al. Heart-Type Fatty Acid-Binding Protein Predicts Long-Term Mortality and Re-Infarction in Consecutive Patients With Suspected Acute Coronary Syndrome Who Are Troponin-Negative. J Am Coll Cardiol. 2010;55(23):2590–8.
7. Brilakis ES, Wright RS, Kopecky SL, Reeder GS, Williams BA, Miller WL. Bundle branch block as a predictor of long-term survival after acute myocardial infarction. Am J Cardiol. 2001;88(3):205–9.
8. Hindman MC, Wagner GS, JaRo M, Atkins JM, Scheinman MM, DeSanctis RW, et al. The clinical significance of bundle branch block complicating acute myocardial infarction. II. Indications for temporary and permanent pacemaker insertion. Circulation. 1978;58(4):689–99.
9. Melgarejo-Moreno A, Galcerá-Tomás J, García-Alberola A, Valdés-Chavarri M, Castillo-Soria FJ, Mira-Sánchez E, et al. Incidence, clinical characteristics, and prognostic significance of right bundle-branch block in acute myocardial infarction: A study in the thrombolytic era. Circulation. 1997;96(4):1139–44.
10. Melgarejo-Moreno A, Galcerá-Tomás J, Garcia-Alberolam A. Prognostic significance of bundle-branch block in acute myocardial infarction: The importance of location and time of appearance. Clin Cardiol. 2001;24(5):371–6.
11. Sgarbossa EB, Pinski SL, Topol EJ, Califf RM, Barbagelata A, Goodman SG, et al. Acute myocardial infarction and complete bundle branch block at hospital admission: Clinical characteristics and outcome in the thrombolytic era. J Am Coll Cardiol. 1998;31(1):105-10.
12. Ricou F, Nicod P, Gilpin E, Henning H, Ross J. Influence of right bundle branch block on short- and long-term survival after acute anterior myocardial infarction. J Am Coll Cardiol. 1991;17(4):858–63.
13. Go AS, Barron HV, Rundle AC, Ornato JP, Avins AL. Bundle-branch block and in-hospital mortality in acute myocardial infarction. Ann Intern Med. 1998;129(9):690–7.
14. Islam MN, Ali MA, Smhkjhjhgaha GK, Islam MF, Islam KQ, Rahman MS. Incidence and prognostic significance of right bundle branch block complicating acute myocardial infarction. Bangladesh Med Res Counc Bull. 2002;28(1):26–35.
15. Melgarejo-Moreno A, Galcera-Tomas J, Garcia-Alberola A, et al. Prognostic significance of bundle-branch block in acute myocardial infarction: the importance of location and time of appearance. Clin Cardiol. 2001;24:371–76.
16. Brilakis ES, Wright RS, Kopecky SL, et al. Bundle branch block as a predictor of long-term survival after acute myocardial infarction. Am J Cardiol. 2001;88:205–9.
17. Vivas D, Perez-Vizcayno MJ, Hernandez-Antolin R, et al. Prognostic implications of bundle branch block in patients undergoing primary coronary angioplasty in the stent era. Am J Cardiol. 2010;105:1276–83.
18. Guerrero M, Harjai K, Stone GW, et al. Comparison of the prognostic effect of left versus right versus no bundle branch block on presenting electrocardiogram in acute myocardial infarction patients treated with primary angioplasty in the primary angioplasty in myocardial infarction trials. Am J Cardiol. 2005;96(4):482-8.
19. Lewinter C, Torp-Pedersen C, Cleland JG, et al. Right and left bundle branch block as predictors of long-term mortality following myocardial infarction. Eur J Heart Fail. 2011;13:1349–54.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

20. Wong CK, Stewart RA, Gao W, et al. Prognostic differences between different types of bundle branch block during the early phase of acute myocardial infarction: insights from the Hirulog and Early Reperfusion or Occlusion (HERO)-2 trial. Eur Heart J. 2006;27(1):21-8.
21. Wang J, Luo H, Kong C, Dong S, Li J, Yu H, et al. Prognostic value of new-onset right bundle-branch block in acute myocardial infarction patients: A systematic review and meta-analysis. Vol. 2018, Peer J. 2018.
22. Iwasaki J, Kono K, Katayama Y, Takahashi N, Takeuchi K, Tanakaya M, et al. Prognostic significance of right bundle branch block in patients with acute inferior myocardial infarction. Acta Med Okayama. 2009;63(1):25–33.
23. Xiang L, Zhong A, You T, Chen J, Xu W, Shi M. Prognostic significance of right bundle branch block for patients with acute myocardial infarction: A systematic review and meta-analysis. Vol. 22, Medical Science Monitor. 2016. p. 998–1004.
24. Ricou F, Nicod P, Gilpin E, et al. Influence of right bundle branch block on short- and long-term survival after inferior wall Q-wave myocardial infarction. Am J Cardiol. 1991;67:1143–46.
25. Hod H, Goldbourt U, Behar S. Bundle branch block in acute Q wave inferior wall myocardial infarction. A high risk subgroup of inferior myocardial infarction patients. The SPRINT Study Group. Secondary Prevention Reinfarction Israeli Nifedipine Trial. Eur Heart J 1995;16(4):471-7.

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