

ORIGINAL ARTICLE

FREQUENCY OF VARIOUS RISK FACTORS AND THEIR CORRELATION WITH OUTCOME IN COMPLETE HEART BLOCK PATIENTS COMING TO A TERTIARY CARE HOSPITAL

Faizania Shabbir, Irum Rehman*, Tausif Ahmed Rajput**, Tanvir Ahmed Raja***

Department of Physiology, Gujranwala Medical College, Gujranwala, *Margalla Institute of Health Sciences, Rawalpindi,

**Pharmaceutical and Allied Health Sciences, Shifa College of Pharmaceutical Sciences, Shifa Tameer-e-Millat University, Islamabad,

*** Rawalpindi Institute of Cardiology, Rawalpindi, Pakistan

Objective: To determine the frequency of various risk factors and their correlation with outcome in patients having complete heart block. **Methods:** This Prospective cohort study was conducted at Rawalpindi Institute of Cardiology, Rawalpindi for a duration of six months. A total of 153 patients from both genders having complete heart block coming to Rawalpindi Institute of Cardiology were recruited in the study. The patients included in the study were evaluated for aetiology of complete heart block by history, physical examination, electrocardiography, blood tests, chest X-ray and echocardiography. A proforma was designed and filled by duty doctor for each patient. The proforma included demographic details, risk factors, presenting complaints, vitals and other parameters. The outcome of these patients (pacemaker implantation/medical treatment/death) was determined in the later part of the study and recorded on proforma. **Results:** Hypertension was the most common risk factor (43.8%) observed in patients of complete heart block in our study. There was no significant difference in the outcome in patients having risk factor of hypertension and smoking. However, a significant difference was observed in frequency of pacemaker implantation in diabetics as compared to non-diabetics ($p=0.039$). **Conclusions:** Hypertension was present in majority of complete heart block patients. The outcome however was not affected by most of risk factors. Only in diabetic risk factor group, significantly fewer numbers of patients were implanted with pacemaker. Death was also not significantly correlated with any particular risk factor.

Keywords: correlation, risk factors, outcome, complete heart block, pacemaker

Pak J Physiol 2020;16(2):26–9

INTRODUCTION

In the present world, most deaths occur due to cardiovascular diseases. It is estimated that annually 17.5 million people die due to cardiovascular diseases.¹ Various preventive programs are designed to decrease the burden of cardiovascular diseases by reducing the risk factors. These programs comprise of various measures that make the 'ABCs' (appropriate use of Aspirin, control of Blood pressure, check on blood Cholesterol) better. They also aim to reduce sodium intake and smoking and to increase physical activity.²

One of the significant cardiovascular disorders includes heart block. Heart block in the increasing order of severity is first degree heart block, second degree heart block and third degree or complete heart block. In the most severe type, the atria and ventricles show complete dissociation. No atrial impulse is successful to reach ventricles. Heart block can be congenital or acquired and acquired cases can be due ischemia or without ischemia.³ Atrioventricular blocks are common in general population; first degree being most frequent followed by second and third degree. Although complete heart block is the least common, but is most serious and can be fatal at times. Its incidence in general population is around 0.02% to 0.04%.⁴ Diagnosis of complete heart block depends on absolute dissociation

between atria and ventricles together with an increased atrial rate than ventricular rate. Patients of complete heart block usually present with symptoms due to occurrence of severe bradycardia.⁵

There are various risk factors that engage in development of cardiovascular diseases; diabetes mellitus, hypertension and smoking being more common. According to world health organization, every eleventh adult in this world is suffering from diabetes and the number is on a rise and will reach 592 million by 2035.^{6,7} In individuals having type 2 diabetes mellitus, the endothelium gets damaged resulting in atherothrombosis that increases the possibility of cardiovascular events.⁸ The persistent hyperglycaemia affects hearts and the person can end up in coronary artery disease, myocardial infarction, or may die suddenly due to arrhythmias. Review of literature also reveals association of type 2 diabetes mellitus with complete heart block.⁹

Hypertension is considered as a vital public health issue. It is a chronic health problem and in United Kingdom one third of population suffers from this problem. The risk of cardiovascular and cerebrovascular accidents increases in the presence of hypertension. Preventing hypertension is a supreme health challenge of modern world.^{10,11} Despite the known adverse effects

of hypertension this serious problem remains undermined because many patients either remain undiagnosed, do not receive proper treatment or do not comply to the treatment.¹² Cigarette smoking also adversely affects health. Every 6th second a person dies due to consequences of smoking. Smoking practice is more common in low income countries. It increases body mass index which complicates and aggravates the damage due to smoking, resulting in increased mortality in East Asian countries due to cardiovascular diseases.¹³

The present study was designed to see the association of various risk factors with complete heart block in patients coming to a tertiary care hospital and their outcome.

PATIENTS AND METHODS

The study was Prospective cohort study and was conducted at Rawalpindi Institute of Cardiology, Rawalpindi. The duration of study was six months. The study was started after formal approval from ethical committee of Rawalpindi Institute of Cardiology, Rawalpindi. Sample size was calculated using WHO sample size calculator assuming confidence level of 95%, alpha error of 5%, study power of 80%, anticipated population proportion with AMI of 8% and desired precision of 4%.¹⁴ A total of 153 (93 male and 60 female) patients (mean age: 63 years) having complete heart block were included in the study. Patients presenting to emergency with complaints of chest pain, vertigo, dizziness or loss of consciousness and having electro-cardiographic manifestations of complete heart block were included in the study. Patients having congenital heart block, immunocompromised state, malignancy or serious comorbid condition were excluded from the study.

Complete history, general physical examination, baseline investigations, electrocardiography (for confirmation of complete heart block), chest X-ray (to observe cardiomegaly) and echocardiography (to observe size, structure, and function of different parts of heart) of included patients were carried out. On a predesigned proforma the consent, demographic details and risk factors were identified.¹⁵ The proforma included the risk factors of diabetes, hypertension, smoking and absence of risk factor. The patients were monitored daily for their vitals and ECG and followed until the time of their discharge from hospital for their outcome. The outcome was classified into three categories (pacemaker implantation/medical treatment/death)

Data was analysed by using SPSS-22. Value of quantitative variables was expressed as exact numbers and frequencies as percentages. Outcome among various risk factor groups was compared using Pearson Chi-Square test. The correlation between various risk factors and their outcomes were assessed by Pearson's

Correlation and $p < 0.05$ was considered statistically significant.

RESULTS

A total of 153 patients were assessed for the risk factors for development of complete heart block and each risk factor was then investigated for the outcome, i.e., whether the pacemaker was implanted/not implanted or the patient died. In our study population, the most frequent risk factor observed was hypertension (43.8%), followed by diabetes (34.6%) and smoking (20.3%). In three patients (1.96%), there was no mentioned risk factor (Table-1).

The patients after assessment for risk factors were followed for their treatment plan/outcome. Out of 53 diabetic patients, 21 were implanted with a pacemaker, 26 were given medical treatment and 6 patients died. Out of 67 patients having hypertension as a risk factor, 36 were implanted with a pacemaker, 26 were given medical treatment and 5 patients died. Out of 31 patients having smoking as a risk factor, 18 were implanted with a pacemaker, 10 were given medical treatment and 3 patients died (Table-2).

On comparison of outcome in various risk factor groups, it was found that outcome was not affected by most of risk factors. Only in diabetic risk factor group, significantly fewer numbers of patients were implanted with pacemaker. Death was also not significantly correlated with any particular risk factor (Table-3).

Pearson's correlation values show that none of the correlations are significant. Positive and negative signs represent positive and negative correlation respectively but are not significant ($p > 0.05$) (Table-4).

Table-1: Frequency of various risk factors in patients of complete heart block presenting to a tertiary care hospital

| Risk factors | No. of patients | Percentage |
|-----------------|-----------------|------------|
| Diabetes | 53 | 34.6 |
| Hypertension | 66 | 43.8 |
| Smoking | 31 | 20.3 |
| No risk factors | 3 | 1.96 |
| Total | 153 | 100 |

Table-2: Outcome of complete heart block patients having various risk factors

| Risk factor | Outcome | | |
|---------------------|-----------|--------------|-------|
| | Pacemaker | No pacemaker | Death |
| Diabetes (n=53) | 21 | 26 | 6 |
| Hypertension (n=67) | 36 | 26 | 5 |
| Smoking (n=31) | 18 | 10 | 3 |

Table-3: Pearson Chi-square test for comparison of outcome in various risk factor groups (p-values)

| Risk factor | Outcome | | |
|---------------------|-----------|--------------|-------|
| | Pacemaker | No pacemaker | Death |
| Diabetes (n=53) | 0.039* | 0.102 | 0.196 |
| Hypertension (n=67) | 0.281 | 0.360 | 0.563 |
| Smoking (n=31) | 0.223 | 0.178 | 0.454 |

*Significant

Table-4: Pearson's Correlation between risk factors and outcome

| Risk factor | Outcome | | | | | |
|---------------------|-----------|-------------|--------------|-------------|----------|-------------|
| | Pacemaker | | No pacemaker | | Death | |
| | <i>p</i> | Correlation | <i>p</i> | Correlation | <i>p</i> | Correlation |
| Diabetes (n=53) | 0.054 | -0.156 | 0.151 | 0.117 | 0.247 | 0.094 |
| Hypertension (n=67) | 0.461 | 0.060 | 0.602 | -0.043 | 0.878 | -0.012 |
| smoking (n=31) | 0.338 | 0.078 | 0.261 | -0.091 | 0.673 | 0.034 |

DISCUSSION

In our study, the frequency of various risk factors in complete heart block patients were studied. The most common risk factor found was hypertension (43.8%), followed by diabetes (34.6%) and smoking (20.3%). Complete heart block was also found in 1.96% patients without any risk factor. Pacemaker implantation was more common among the smokers (58.06%) as compared to hypertensive (53.73%) and diabetic patients (39.62%). Majority of deaths occurred in the diabetic risk factor group (11.3%) than in smokers (9.67%) or hypertensive patients (7.46%).

In a retrospective observational cohort study conducted by Sundhu *et al*, the most common risk factor for complete heart block corresponds with the results of our study. In this study only new cases of complete heart block coming to Fairview hospital United States of America were included. The most frequent risk factor observed among the patients was hypertension (79%). Smoking was also a major risk factor as (51.6%) patients were former smokers and (11.3%) were current smokers. Diabetes was relatively less prevalent among the study population (37%).³ Hindi *et al*, reported a case where the patient who was an active smoker had uncontrolled hypertension due to stenosis of renal artery on both sides. This condition resulted in hypertensive cardiomyopathy and complete heart block. The suggested mechanism was hypertension caused cardiomyopathy that induced abnormalities in conducting system of heart. Implantation of a permanent pacemaker was considered to be essential for treating complete heart block due to hypertensive cardiomyopathy. In our study 53.7% of patients having hypertension as risk factor were implanted with a pacemaker. Hypertensive cardiomyopathy however was not present in all hypertensive patients.¹⁶ Lionakis *et al*, also presented a case of uncontrolled hypertension. The patient presented with very high arterial blood pressure. ECG revealed complete AV block and imaging showed presence of type B dissecting aneurysm of aorta. The proposed mechanism was that prolonged hypertension can cause fibrosis of myocardium that interferes with the normal conducting system of heart.¹⁷

Review of literature reveals a strong association of diabetes with complete heart block. Although in our study it was the second most common risk factor found. Agarwal *et al*¹⁸, presented a case report where a 62 years old man with type 2 diabetes mellitus for one year lost his consciousness. History,

examination and ECG led to diagnosis of complete heart block. The patient had a strong family history for both diabetes and complete heart block. Patient's two brothers and mother were also diabetics and suffered from complete heart block. Hyperglycaemia in diabetics is suggested to cause endothelial damage and result in adverse cardiovascular outcome. Agarwal *et al*¹⁸, suggested a positive correlation between diabetes and CHB in another study. A cross-sectional study where 100 diabetic patients with cardiac arrhythmias were included in the study. It was found that CHB occurred in 20% of patients. It was proposed that diabetes causes chronic micro- and macro-vascular damage resulting in cardiovascular system deterioration.

Movahed *et al*¹⁹, also found diabetes as the common risk factor in CHB patients. Using multivariate analysis, they observed a strong association of diabetes with third degree heart block (odds ratio came out to be 3.1; with a confidence interval of 95% ranging from 3.0 to 3.3; and a $p < 0.0001$). Presence of complete heart block in diabetics may be a cause of high death rate in diabetics due to cardiovascular complications.

The risk factor of smoking was also included in our study. This risk factor was found to be present in 20.3% of our patients. Gepner *et al*, conducted a study to see whether the damage caused by cigarette smoking is reversible or not. Three years of abstinence from smoking in subjects who were chronic smokers in the past did not reverse the cardiac abnormalities as reflected by ECG. Hence smoking is thought to cause irreversible cardiac changes. Measures should be adopted to prevent smoking in early years, before a person is used to it and smokes greater number of cigarettes per day.²⁰ Yusuf *et al*, studied the effect of various risk factors in development of cardiovascular diseases and smoking was found to one of the important factors that increased the risk for cardiovascular dysfunction.²¹ Dinas *et al*, suggested the mechanism by which smoking is injurious to cardiovascular system. Active and passive smoking both are harmful. Smoking indirectly causes cardiovascular disturbances by affecting autonomic nervous system that enhances the sympathetic nervous system drive and reduces heart rate variability.²²

Contrary to the results of most researches, where the risk factors were found to affect cardiovascular functioning, Hashmi *et al*, found no significant association of age, sex, smoking, hypertension, diabetes mellitus and other factors with the development of complete heart block.²³

CONCLUSION

The most frequent risk factor observed in complete heart block patients in our study was hypertension. No correlation was found between the risk factors and outcome except for diabetic patients. In patients having diabetes, pacemaker implantation was done in significantly fewer numbers of patients. The correlation between any particular risk factor and death was also not significant. Further studies should be carried out to see the long-term consequences of these risk factors. Therapies should be designed with the aim of prevention of these risk factors and hence putting a halt to adverse outcomes.

REFERENCES

1. GBD 2013 Mortality and Causes of Death Collaborators. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 2015;385(9963):117–71.
2. Ritchey MD, Wall HK, Owens PL, Wright JS. Vital Signs: State-Level Variation in Nonfatal and Fatal Cardiovascular Events Targeted for Prevention by Million Hearts 2022. *MMWR Morb Mortal Wkly Rep* 2018; 67(35): 974–82.
3. Sundhu M, Yildiz M, Syed M, Shah B, Gul S, Afzal O, *et al.* Clinical characteristics and outcomes of patients with ischemic and non-ischemic complete heart block. *Cureus* 2017;9(5):e1244.
4. Knabben V, Chhabra L, Slane M. Third-Degree Atrioventricular Block. [Updated 2020 Aug 8]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK545199/>
5. Yang YC, Pata RK, Aung TT. A case of complete heart block with diagnostic challenge and therapeutic dilemma. *J Investig Med High Impact Case Rep* 2018;6:2324709618788110.
6. Ong SE, Koh JJK, Toh S-AES, Chia KS, Balabanova D, McKee M, *et al.* Assessing the influence of health systems on type 2 diabetes mellitus awareness, treatment, adherence, and control: a systematic review. *PLoS One* 2018;13(3):e0195086.
7. Guariguata L, Whiting DR, Hambleton I, Beagley J, Linnenkamp U, Shaw JE. Global estimates of diabetes prevalence for 2013 and projections for 2035. *Diabetes Res Clin Pract* 2014;103(2):137–49.
8. Van Sloten TT, Henry RM, Dekker JM, Nijpels G, Unger T, Schram MT, *et al.* Endothelial dysfunction plays a key role in increasing cardiovascular risk in type 2 diabetes: the Hoorn study. *Hypertension* 2014;64(6):1299–305.
9. Agarwal G, Singh SK. An intriguing family with type 2 diabetes mellitus and complete heart block. *Indian J Endocr Metab* 2017;21: 784–6.
10. Centers for Disease Control and Prevention (CDC). Vital signs: prevalence, treatment, and control of hypertension-United States, 1999–2002 and 2005–2008. *MMWR Morb Mortal Wkly Rep* 2011;60:103–8.
11. Cuspidi C, Meani S, Valerio C, Esposito A, Sala C, Maisaidi M, *et al.* Ambulatory blood pressure target organ damage and aortic root size in never-treated essential hypertensive patients. *J Hum Hypertens* 2007;21:531–8.
12. Jordan J, Kurschat C, Reuter H. Arterial Hypertension. *Dtsch Arztebl Int* 2018;115(33–34):557–68.
13. Kim HN, Shin MA, Roh JH, Han MK, Won YM, Cho IR, *et al.* Association between cigarette smoking frequency and health factors among Korean adults. *Iran J Public Health* 2018;47(Suppl 1):19–26.
14. Laslett LJ, Alagona P Jr, Clark BA 3rd, Drozda JP, Saldivar F, Wilson SR, *et al.* The worldwide environment of cardiovascular disease: prevalence, diagnosis, therapy, and policy issues: A report from the American College of Cardiology. *J Am Coll Cardiol* 2012;60(Suppl-25):1–49.
15. Knekt P, Rissanen H, Järvinen R, Heliövaara M. Cohort profile: the Finnish Mobile Clinic Health Surveys FMC, FMCF and MFS. *Int J Epidemiol* 2017;46(6):1760–61.
16. Hindi Z, Hindi Y, Batarseh R. A rare case of complete heart block in a young patient. *Case Rep Cardiol* 2018;2018:1493121.
17. Lionakis N, Moyssakis I, Gialafos E, Dalanis N, Votteas V. Aortic dissection and third-degree atrioventricular block in a patient with a hypertensive crisis. *J Clin Hypertens (Greenwich)* 2008;10(1):69–72.
18. Agarwal G, Singh SK. Arrhythmias in type 2 diabetes mellitus. *Indian J Endocr Metab* 2017;21:715–8.
19. Movahed MR, Hashemzadeh M, Jamal MM. Increased prevalence of third-degree atrioventricular block in patients with type II diabetes mellitus. *Chest* 2005;128(4):2611–4.
20. Gepner AD, Piper ME, Leal MA, Asthana A, Fiore MC, Baker TB, *et al.* Electrocardiographic changes associated with smoking and smoking cessation: Outcomes from a randomized controlled trial. *PLoS One* 2013;8(4):e62311.
21. Yusuf S, Hawken S, Ounpuu S, Dans T, Avezum A, Lanas F, *et al.* Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *Lancet* 2004;364(9438):937–52.
22. Dinas PC, Koutedakis Y, Flouris AD. Effects of active and passive tobacco cigarette smoking on heart rate variability. *Int J Cardiol* 2013;163:109–15.
23. Hashmi KA, Shehzad A, Hashmi AA, Khan A. Atrioventricular block after acute myocardial infarction and its association with other clinical parameters in Pakistani patients: an institutional perspective. *BMC Res Notes* 2018;11(1):329.

Address for Correspondence:

Dr. Faizania Shabbir, Associate Professor, Department of Physiology, Gujranwala Medical College, Gujranwala, Pakistan. **Cell:** +92-321-9549270
Email: faizaniatausif@gmail.com

Received: 2 Mar 2020

Reviewed: 19 Jun 2020

Accepted: 22 Jun 2020

Contribution of Authors:

FS: Study design, Data analysis

IR: Data interpretation, Final review

TAR: Drafting, Critical review

TAR: Interpretation of data, Final review

Funding disclosure: None to declare

Conflict of interest: None to declare