International Journal of Advances in Medicine
Pandey R et al. Int J Adv Med. 2017 Oct;4(5):1222-1226
http://www.ijmedicine.com
pISSN 2349-3925 | eISSN 2349-3933
DOI: http://dx.doi.org/10.18203/2349-3933.ijam20173643

Original Research Article

A case control study in BMC Sagar to identify the risk factors for heart failure in patients with recently diagnosed myocardial infarction

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Received: 10 July 2017
Accepted: 28 July 2017

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ABSTRACT

Background: This study was conducted to identify the risk factors for heart failure (HF) in recently diagnosed myocardial infarction (MI) patients in Bundelkhand region of Madhya Pradesh, India.
Methods: In this hospital-based, case-control study, the participants were all new myocardial infarction patients hospitalized from April 2016 to March 2017 in Bundelkhand Medical College (BMC) and associated hospital Sagar, Madhya Pradesh. There were 1,691 new cases with heart failure and 6,764 patients without heart failure as controls. Controls were selected randomly as per incidence density sampling. Odds ratios (ORs) with a 95% confidence interval (CI) was calculated to identify potential risk factors, using conditional logistic regression models.
Results: The mortality rate was 18.2% in the cases and (12.1%) in the controls ($p<0.05$). Important risk factors for heart failure were: stroke (OR, 2.00; 95% CI, 1.39 to 2.89), and right bundle branch block (RBBB) (OR, 2.86; 95% CI, 1.95 to 4.19). The factors significantly associated with heart failure Diabetes, hypertension, atrial fibrillation, ventricular tachycardia, and age. Incidence ($p<0.05$). Significant factor in women was diabetes (OR, 1.41; 95% CI, 1.05 to 1.88) while in men age, hypertension, and RBBB are important.
Conclusions: This study might help to identify and monitor the predictive risk factors for heart failure in myocardial infarction patients. The type of risk factors was different in men and women.

Keywords: Myocardial infarction, Mortality, Risk factor

INTRODUCTION

Heart failure is an important growing concern in India and worldwide. It is a state in which the heart cannot pump sufficient blood for the body's metabolic needs. Heart failure has more incidence in patients with a congenital or acquired defect in heart, which leads to recurrent hospitalizations and decreased life expectancy. Heart failure is a global killer.[1-4]

Heart failure result out of multiple cardiovascular diseases, which includes myocardial infarction, hypertension, diabetes, and chronic kidney disease. It carries a high mortality rate despite advancements in medical management.[5]

Heart failure leads to a noticeable deterioration in quality of life.[6,7] In spite of improvement and promotion in variety of approaches to treatment, hear failure remains an important health problem. Identification and monitoring of its risk factors, are considered vital to heart failure health care. Treatment, prevention, and of heart failure demands precise detection, with an area wise approach in communities and throughout the country.[3-5,8] The epidemiology of heart failure has been very well explained. There are gradual updates for developed nations.[2-4] There have been timely reporting for some

other Asian countries like Japan and Malaysia.[8,9] Although no comparison of risk factors for heart failure has yet been made, mainly between men and women. Myocardial Infarction is the leading cause of mortality in India and is currently being addressed as the most important challenge facing India's health care system. This study was conducted to determine the risk factors for heart failure in Indian patients with myocardial infarction.

METHODS

This study was a hospital-based, case-control study. The participants included new MI patients admitted from April 2016 to March 2017 in hospitals in medicine department of Bundelkhand Medical College (BMC) Sagar. Here the data on 1,691 new cases with heart failure were compared with those of 6,764 patients without heart failure. The cases were selected by census and the controls were selected, at the same time with the cases, from patients without heart failure during admission due to myocardial infarction.

The sampling method was random sampling method was used. The controls and cases were matched on the date of admission and myocardial infarction. The dates of death and also of myocardial infarction and heart failure diagnosis were noted. In order, to obtain an estimate of rate ratios, random selection of four controls per one case was done and this was matched on the date at myocardial infarction and heart failure diagnosis. In India, the Framingham clinical criteria (the presence of two major criteria or one major criterion plus two minor criteria) and an echocardiogram are used to diagnose HF. Clinical examination are not accepted as sufficient for diagnosing HF alone. These criteria are more valuable when accompanied by an echocardiogram. The major criteria's consisted of paroxysmal nocturnal dyspnea, Jugular vein distention, crepitations, cardiomegaly, acute pulmonary edema, S3 gallop, increased central venous pressure, hepatojugular reflux, and weight loss of more than 4.5 kg in response to treatment. The minor criteria included bilateral ankle edema, nocturnal cough and dyspnea on ordinary activity. Also, hepatomegaly, pleural effusion, a decrease in vital capacity by one third and tachycardia (heart rate >120 beats/ min) were included.

The patients with no Framingham diagnostic criteria and no positive echocardiographic findings were excluded from the study. The other variates included were age, sex, literacy, smoking, body mass index, the season at disease incidence, and the associated diseases (type 2 diabetes, hypertension, hypercholesterolemia, and congenital heart disease). The information was gathered as part of the patient's medical record.

The diagnosis of MI based on ECG changes like data on left bundle branch block (LBBB), right bundle branch block (RBBB), atrial fibrillation (AF), and ventricular tachycardia (VT) with reference to Braunwald's heart disease (for example, common diagnostic criteria for LBBB: QRS duration ≥120 ms broad, notched, or slurred R waves in leads I, aVL, V5, and V6, small or absent initial r waves in right precordial leads (V1 and V2) followed by deep S waves, absent septal q waves in leads I, V5, and V6, prolonged time to peak R wave (>60 ms) in V5 and V6; for RBBB: QRS duration ≥120 ms, rsr', rsR', or rSR', patterns in leads V1 and V2, S waves in leads I and V6 ≥40 ms wide normal time to peak R wave in leads V5 and V6 but > 50 ms in V1).[10-12]

Statistical analysis

The odds ratio (OR) with a 95% confidence interval (CI) of the associated risk factors heart failure was calculated by conditional logistic regression.

For analysis, univariate analysis was used. The variables with a significance value of p=0.2 were selected for multivariate model and adjust for potential confounding variables was done. Modelling was done for men, women, and all the patients separately. The variables were standardized before entering into regression model. The p-values less than 0.05 were considered significant. Data analysis was done using Stata version 13.0.

RESULTS

The description of all the patients and comparative review of demographic features and risk factors for myocardial infarction between cases and controls are shown in Table 1.

The mean±standard deviation (SD) in age was significantly greater in the cases than the control group.

It was observed that the prevalence of hypertension, diabetes, and smoking was significantly more in cases than in control ($p<0.005$).

The prevalence of RBBB, LBBB, AF, VT, and stroke was significantly higher in the case group than the controls ($p<0.001$). The comparison of clinical data between the cases and the controls is shown in Table 2.

(LBBB,left bundle branch; RBBB, right bundle branch block; AF , atrial fibrillation; VT, ventricular tachycardia; STEMI, ST- segment elevation myocardial infarction).

Study conducted a stratified analysis gender wise with univariate and multiple analysis. The maximum OR of heart failure in all the patients was obtained for RBBB (2.86; 95% CI, 1.95 to 4.19).

The odds ratio obtained by a conditional logistic model to detect the factors associated with heart failure are presented in Table 3 and Table 4.

Table 1: Comparative study of demographic features and risk factors for myocardial infarction between cases and controls.

Characteristics	Cases (n = 1,691)			Controls (n = 6,764)			p-value
	Total	Men	Women	Total	Men	Women	
Age (mean±SD, year)	63.7±13.4	61.9± 13.3	68.2±12.3	61.5±13.3	59.9±13.2	65.8±12.9	<0.001
Illiteracy	883 (52.2)	503 (42.1)	380 (76.4)	3,159 (46.7)	1,836 (37.1)	1,323 (72.4)	0.05
Smoking	722 (42.7)	337 (28.2)	89 (17.9)	2,399 (35.4)	1,395 (28.2)	333 (18.2)	0.001
Hypertension	722 (42.7)	429 (35.9)	293 (58.9)	2,399 (35.4)	1,419 (28.7)	980 (53.6)	<0.001
Diabetes	476 (28.2)	265 (22.1)	211 (42.4)	1,521 (22.5)	901 (18.2)	620 (33.9)	<0.001
Hypercholesterolemia	319 (18.8)	180 (15.0)	139 (27.1)	1,196 (17.6)	740 (14.9)	456 (24.9)	0.26

Table 2: Comparative study of bases line co- morbidity and clinical features of cases and controls.

Characteristics	Cases (n = 1,691)			Controls (n = 6,764)			p-value
	Total	Men	Women	Total	Men	Women	
LBBB	55 (3.2)	43 (3.6)	12 (2.4)	120 (1.7)	77 (1.5)	43 (2.3)	< 0.001
RBBB	53 (3.1)	40 (3.3)	13 (2.6)	62 (0.9)	47 (0.9)	15 (0.8)	< 0.001
AF	92 (5.5)	61 (5.1)	31 (6.2)	206 (3.1)	142 (2.8)	64 (3.5)	<0.001
VT	137 8.2)	97 (8.1)	40 (8.0)	331 (4.8)	234 (4.7)	97 (5.3)	< 0.001
Stroke	46 (2.7)	37 (3.1)	9 (1.8)	91 (1.3)	81 (1.6)	10 (0.5)	< 0.001
STEMI	1,008 (59.6)	728 (60.9)	280 (56.3)	4,331 (64.0)	3,203 (64.8)	1,128 (61.7)	0.001
Thrombolytic	656 (38.7)	480 (40.2)	176 (35.4)	1,614 (23.8)	2,247 (45.5)	740 (40.5)	< 0.001
Hospital mortality	308 (18.2)	196 (16.4)	112 (22.5)	821 (12.1)	553 (11.2)	268 (14.6)	< 0.001
Hospital stay	6.8±15.7	7.4±16.8	5.5±12.5	28.0±36.0	28.3±36.0	27.5±36.0	< 0.001

Table 3: Risk factors for heart failure in patients with myocardial infarction and its unadjusted OR.

Characteristics	Women	p-value	Men	p-value	Total	p-value
Age	1.61 (1.42, 1.83)	0.001	1.29 (1.19, 1.40)	0.001	1.40 (1.31, 1.50)	0.001
Illiteracy	1.29 (1.00, 1.68)	0.05	1.40 (1.20, 1.64)	0.001	1.47 (1.29, 1.67)	0.001
Smoking	1.13 (0.85, 1.49)	0.38	1.36 (1.15, 1.60)	0.001	1.24 (1.08, 1.43)	0.002
Hypercholesterolemia	1.24 (0.97, 1.58)	0.08	1.03 (0.83, 1.27)	0.78	1.17 (1.00, 1.37)	0.05
Diabetes	1.39 (1.04, 1.63)	0.02	1.37 (1.14, 1.64)	0.001	1.42 (1.23, 1.63)	0.001
Hypertension	1.37 (1.10. 1.72)	0.005	1.09 (0.92, 1.28)	0.30	1.26 (1.11, 1.43)	0.001
Stroke	5.81(2.34, 14.39)	0.001	6.69 (4.62, 9.68)	0.001	6.15 (4.37, 8.65)	0.01
AF	2.60 (1.67, 4.06)	0.001	1.10 (0.73, 1.67)	0.63	1.59 (1.19, 2.14)	0.002
VT	2.70 (1.85, 3.93)	0.001	2.27 (1.73, 2.96)	0.001	2.41 (1.94, 2.99)	0.001
LBBB	1.44 (0.75, 2.76)	0.27	6.48 (4.48, 9.36)	0.001	4.21 (3.08, 5.75)	0.001
RBBB	2.45 (1.10, 5.47)	0.03	3.31 (2.09, 5.25)	0.001	3.02 (2.02, 4.50)	0.001
Thrombolytic	0.55 (0.44, 0.68)	0.001	0.46 (0.39, 0.53)	0.001	0.49 (0.43, 0.56)	0.001
Chest pain	5.71 (4.37, 7.44)	0.001	6.95 (5.79, 8.35)	0.001	6.57 (5.65, 7.65)	0.001

Table 4: Risk factors for heart failure in men and women with myocardial infarction and its unadjusted OR.

Characteristics	Women	p-value	Men	p-value	Total	p-value
Age	1.10 (0.95, 1.28)	0.19	1.14 (1.06, 1.23)	0.001	1.13 (1.07, 1.20)	0.001
Diabetes	1.41 (1.05, 1.88)	0.02	1.14 (0.96, 1.35)	0.12	1.25 (1.10, 1.34)	0.001
Hypertension	1.08 (0.80, 1.45)	0.60	1.29 (1.12, 1.50)	0.001	1.20 (1.06, 1.34)	0.002
Stroke	6.77 (0.75, 6.80)	0.09	1.80 (1.16, 2.78)	0.008	2.00 (1.39, 2.89)	0.001
AF	2.39 (1.19, 4.82)	0.01	1.63 (1.16, 2.28)	0.004	1.64 (1.26, 2.12)	0.001
VT	2.06 (1.14, 3.72)	0.02	1.64 (1.25, 2.16)	0.001	1.73 (1.39, 2.14)	0.001
LBBB	1.46 (0.57, 3.71)	0.42	1.62 (1.05, 2.51)	0.03	1.53 (1.09, 2.15)	0.01
RBBB	3.25 (1.01, 10.39)	0.05	3.26 (2.00, 5.33)	0.001	2.86 (1.95, 4.19)	0.001
Thrombolytic	0.76 (0.56, 1.03)	0.09	0.85 (0.74, 0.98)	0.03	0.83 (0.74, 0.93)	0.002
Chest pain	1.16 (0.75, 1.77)	0.49	1.32 (1.07, 1.65)	0.01	1.38 (1.17, 1.63)	0.001

Along with an increase in age by one year, the likelihood of heart failure incidence increased by 1.13 times. Incidence of stroke is more than twice the likelihood of heart failure incidence (OR, 2.00; 95% CI, 1.39 to 2.89). Major risk factors for heart failure are included age, type 2 diabetes, hypertension, LBBB, RBBB, AF, VT, and stroke.

Values are presented as odds ratio (95% confidence interval). (LBBB, left bundle branch; RBBB, right bundle branch block; AF, atrial fibrillation; VT, ventricular tachycardia).

The important and predictive risk factors for heart failure in men and women are found to be deferent. The major risk factor in men was hypertension (p=0.001) and diabetes (p=0.02) in women. Age was found to be a major risk factor in men. Stroke, age, and LBBB were not significant for heart failure incidence in women.

DISCUSSION

This study shows the heart failure epidemiology in Bundelkhand. The important risk factors for heart failure in in myocardial infarction patients were type 2 diabetes mellitus, hypertension, stroke, RBBB, and age. Our study showed some differences in risk factors between men and women. The factors that might affect the development of heart failure are infarct size, ventricular remodeling, stunned myocardium, recurrent myocardial ischemia, mechanical complications, and hibernating myocardium.[13] The chances of myocardial infarction ending up in heart failure were seen more in men and probability increases with age. About 40% of myocardial infarctions are associated with left ventricular systolic dysfunction.[15]

In a study by Grazuleviciene and Dulskiene in Kaunas, Lithuania from 1997 to 2000, 448 patients with first-time myocardial infarction were studied.[16] The incidence of heart failure for men with first myocardial infarction showed that the syndrome was found in 46.4% of patients. Our finding is inconsistent with this study.

The heart failure mortality ratio in myocardial infarction patients was found to be 18.2%, more than the 13% reported by the study of Velazquez et al.[17] As per the previous studies, the prevalence of HF has variation of 1.3% to 6.7%. This study reports the greater prevalence of heart failure in myocardial infarction patients.[9,14,18-20]

Higher incidence of heart failure and the mortality in myocardial infarction patients in Bundelkhand could be explained by the patients' late referral to emergency and cardiac care units, scared of diagnostic facilities, and limited access to cardiac care.

This study found that atrial fibrillation has a significant role in heart failure incidence in myocardial infarction patients. This finding is in accordance with the findings of the Framingham heart study. The concordance of heart failure and atrial fibrillation had a worse prognosis than the incidence of only heart failure or atrial fibrillation.[21]

CONCLUSION

To the best of our knowledge, we found few studies that investigate the risk factors for heart failure in myocardial infarction patients classified by gender. The high-risk factors for heart failure in women myocardial infarction patients were diabetes, RBBB, AF, and VT. The high-risk factors for heart failure in men myocardial infarction patients were age, hypertension, stroke, VT, AF, RBBB, LBBB, and chest pain resistant to treatment. There was greater risk of heart failure in men myocardial infarction patients. The highest risk of heart failure was found for RBBB in all myocardial infarction patients. The findings of this study could be an important reference for physicians and researchers.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

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Cite this article as: Pandey R, Pandey S. A case control study in BMC Sagar to identify the risk factors for heart failure in patients with recently diagnosed myocardial infarction. Int J Adv Med 2017;4:1222-6.