https://doi.org/10.37939/jrmc.v28i3.2578

The Effect Of Demographic Factors And Comorbidities On Ejection Fraction Outcome In Acute Myocardial Infarction Patients

Kausar Malik[1], Faiza Batool[2], Shazia Siddiq[3], Lubna Meraj[4]

Abstract

Objective: Left ventricular dysfunction commonly occurs as a complication after acute myocardial infarction. This study sought to explore the occurrence of acute left ventricular dysfunction among patients who have experienced an acute myocardial infarction (AMI)

Methods: A prospective observational study was conducted at a tertiary care hospital over 12 months from February 2022 to January 2023. Non-probability convenience sampling technique was used to recruit the participants following informed consent. All patients aged 18 or more admitted with acute myocardial infarction confirmed by clinical, ECG findings and cardiac biomarkers were included in the study and patients with pre-existing valvular heart disease, previous history of myocardial infarction and history of cardiac surgery were excluded from the study. Socio-demographic details and risk factors like hypertension and diabetes were recorded, alongside presenting symptoms and vital signs. Echocardiography was performed to assess left ventricular function, including ejection fraction and other parameters. Data was analyzed utilizing SPSS version 28. The ejection fraction data were stratified into three distinct categories: 1) between 25% and 40%, 2) between 41% and 55%, and 3) between 55% and 70%. The Chi-square test was employed to assess significant differences in the proportion of patients with different demographic characteristics, co-morbidities and risk factors falling into each category. The level of statistical significance was $p < 0.05$.

Results: 100 patients with acute myocardial infarction were recruited. 69% were male and the mean age was 61 years. Most patients (55%) had an ejection fraction (EF) between 25% and 40% and the majority of patients (63%) had acute anterior MI. The coexistence of hypertension with diabetes and smoking was prevalent (74% and 48% respectively), with significant associations ($p = 0.000$ and 0.02). A substantial difference in EF distribution was observed between anterior and inferior wall MI patients ($p = <0.0001$), with 71% of anterior MI patients having EF below 40%, compared to 27% of inferior MI patients.

Conclusion: This study provides valuable insights into the decrease in ejection fraction observed in patients with acute myocardial infarction, particularly those presenting with anterior wall MI.

MeSH Keywords: acute myocardial infarction, ventricular ejection fraction, anterior wall myocardial infarction.

[1,2] Professor of Medicine, HITEC-IMS, Taxila; [3] Professor of Medicine, Ponch Medical College, Rawalakot, AJK; [4] Associate Professor, Rawalpindi Medical University.

Correspondence: Dr. Faiza Batool, Professor of Medicine, HITEC-IMS, Taxila. **Email:** fayzabatool@gmail.com

Cite this Article: Malik K, Batool F, Siddiq S, Meraj L. The Effect Of Demographic Factors And Comorbidities On Ejection Fraction Outcome In Acute Myocardial Infarction Patients. JRMC. 2024 Sep. 27;28(3).475-480. https://doi.org/10.37939/jrmc.v28i3.2578.

Received March 18, 2024; accepted September 17, 2024; published online September 26, 2024

1. Introduction

Acute myocardial infarction (AMI) is a leading cause of death and disability worldwide,[1] and left ventricular dysfunction is a frequent complication following acute myocardial infarction.[2]

Left ventricular dysfunction refers to impaired systolic or diastolic function of the left ventricle, resulting in reduced cardiac output and compromised hemodynamics. It can have profound implications for patients' prognosis and quality of life.[3]

The primary cause of left ventricular dysfunction in AMI is the ischemic injury resulting from coronary artery occlusion, leading to myocardial cell death and scar formation.[4] The healing process following AMI involves complex remodelling mechanisms, including inflammation, fibrosis, and changes in ventricular geometry. These processes contribute to ventricular dysfunction and adverse remodeling.[5]

Left ventricular dysfunction following acute myocardial infarction is associated with an increased risk of heart failure, recurrent myocardial infarction, arrhythmias, and cardiovascular mortality. The development of heart failure is a significant consequence of left ventricular dysfunction, leading to symptoms such as dyspnea, fatigue, and exercise intolerance.[6]

Early and successful revascularization, either through percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG), is crucial in salvaging myocardial tissue and improving left ventricular function.[7] Pharmacological interventions, including beta-blockers, angiotensin-converting enzyme inhibitors (ACE inhibitors), angiotensin receptor blockers (ARBs), and mineralocorticoid receptor antagonists (MRAs), have been shown to improve

outcomes in patients with left ventricular dysfunction.[8] Cardiac resynchronization therapy (CRT) and implantable cardioverter-defibrillators (ICDs) have demonstrated efficacy in reducing mortality and hospitalization rates in selected patients with left ventricular dysfunction.[9]

Early recognition, risk stratification, and implementation of appropriate management strategies are crucial in improving outcomes. The purpose of our study is to assess the relationship between demographic characteristics, comorbidities, and changes in ejection fraction among acute myocardial infarction patients.

2. Materials & Methods

It is a prospective observational study which was carried out at Sheikh Khalifa bin Zayed al Nahyan Hospital Rawalakot, Pakistan after approval from the ethics review committee. The duration of the study was 12 months from February 2022 till January 2023. The sample size was calculated using a WHO calculator given the combined prevalence of diabetes, hypertension, smoking and ischemic heart disease. Non-probability convenience sampling technique was used. Informed consent was obtained from all study participants before enrollment and the objectives of research were communicated in Urdu. Patient confidentiality and data protection were ensured throughout the study.

All patients aged 18 years or more admitted to the coronary care unit with AMI confirmed by clinical, electrocardiographic findings and cardiac biomarkers were included in the study. Patients with pre-existing significant valvular heart disease, previous history of myocardial infarction and history of cardiac surgery were excluded from the study.

Demographic data like age, gender, medical history and risk factors like hypertension, diabetes, and smoking were noted. Presenting symptoms, vital signs, troponin levels and cardiac biomarkers were also noted. Their ECG findings were noted and echocardiography was performed within 24-48 hours of admission using a standardized protocol. Left ventricular ejection fraction was assessed using two-dimensional (2D) echocardiography done by a cardiologist. Additional parameters, such as left ventricular dimensions, wall motion abnormalities, and the presence of valvular abnormalities, were also recorded.

The collected data was analyzed using SPSS version 28. Baseline characteristics and echocardiographic parameters were summarized using means and standard deviations for continuous variables and frequencies for categorical variables.

The ejection fraction data were stratified into three distinct categories: 1) between 25% and 40%, 2) between 41% and 55%, and 3) between 55% and 70%. The Chi-square test was employed to assess significant differences in the proportion of patients with different demographic characteristics, co-morbidities and risk factors falling into each category. The level of statistical significance was $p < 0.05$.

3. Results

In this study,100 patients with acute myocardial infarction (MI) were recruited. 69% of the patients were male, while 31% were female as shown in Figure 1.

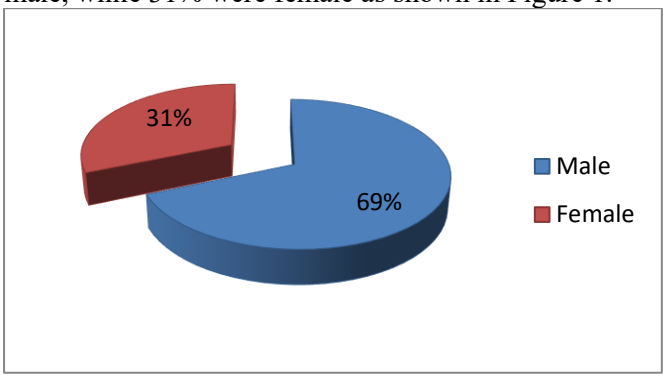

Figure 1: Demographic Data

The mean age was 61 years SD (8.75). Hypertension was present in 70 (70%) patients, diabetes in 53 (53%), and smoking in 56 (56%) as shown in Figure 2.

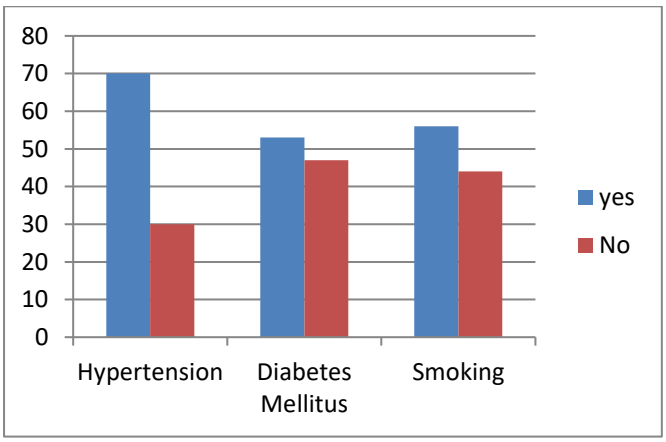

Figure 2: Frequency of Comorbidities and Risk Factors

Most patients (55%) had an ejection fraction (EF) between 25% and 40%, followed by 39% with EF between 41% and 55%, and 6% with EF between 55% and 70%. The majority of patients (63%) had acute anterior MI and 37% had inferior wall MI, with none presenting with posterior or right ventricular infarction as shown in Figure 3.

Gender-based analysis revealed that a higher percentage of females had hypertension (77%) and diabetes (80%) compared to males, while a larger proportion of males were smokers (78%). Statistically significant differences were observed in EF distribution between males and females (p = 0.009) as shown in Table 1.

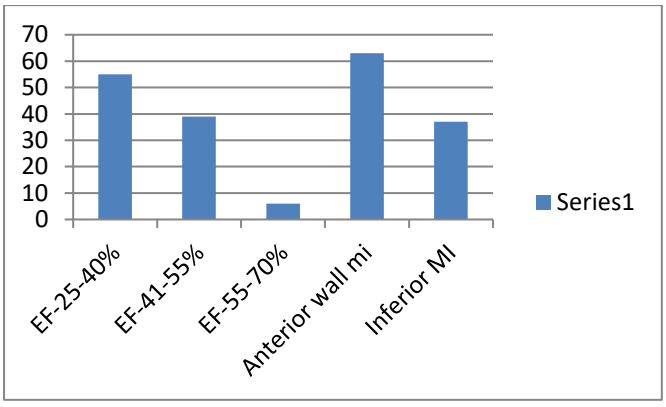

Figure 3: Frequency of Distribution of Ejection Fraction and Location of Myocardial Infarction

Table 1: Frequency of different variables among male and female

	Hypertension	Diabetes	smoking	Anterior wall MI	Inferior wall MI	Ejection fraction: 25-40%	Ejection fraction: 41-55%	Ejection fraction: 55-70%
Male	46	28	54	41	28	34	33	2
Female	24	25	2	22	9	21	6	4

Table 2: Result of Chi-square test showing significant difference based on different variables

Variables	Pearson Chi-Square Asymptotic significance (2-sided)
Gender	
Diabetes mellitus	< 0.0001
Smoking	< 0.0001
Ejection fraction	0.009
Hypertension	
Diabetes mellitus	< 0.0001
Smoking	0.022
Ejection fraction	< 0.0001
Myocardial infarction	< 0.0001
Diabetes	
Ejection fraction	< 0.0001
Myocardial infarction	< 0.0001
Hypertension	< 0.0001
Smoking	
Myocardial infarction	0.002
Hypertension	0.022
Location Of Myocardial Infarction	
Ejection fraction	< 0.0001

The coexistence of hypertension with diabetes and smoking was prevalent (74% and 48% respectively), with significant associations (p <0.0001 and 0.02). Hypertensive patients predominantly had EF between 25% and 40% (72%), contrasting with non-hypertensive patients who mostly had EF between 41% and 55% (80%) (p < 0.0001). Anterior wall MI was significantly more common in hypertensive patients (82%) compared to inferior wall MI (17%) (p <0.0001).

Smoking prevalence was 54% among diabetic patients, with a majority (92%) having EF between 25% and 40%, whereas non-diabetics mostly had EF above 40% (82%) (p <0.0001). A significantly higher proportion of diabetic patients had anterior wall MI (88%) compared to inferior wall MI (0.11%) (p <0.0001).

Smokers predominantly had EF between 25% and 40%, with an even distribution of MI location between the anterior and inferior walls. A higher proportion of smokers also had hypertension (60%) (p = 0.022).

Furthermore, a significant difference in EF distribution was observed between anterior and inferior wall MI patients (p <0.0001), with 71% of anterior MI patients having EF below 40%, compared to 27% of inferior MI patients.

4. Discussion

Left ventricular (LV) systolic function is a critical prognostic factor in coronary artery disease and one of the complications of an acute coronary event.[10] Left ventricular ejection fraction (LVEF) should be evaluated in all patients after acute myocardial infarction (AMI).

The study conducted in Peshawar, Pakistan,[11] revealed that anterior wall myocardial infarction (AMI) predominates as the most prevalent type of acute myocardial infarction, consistent with our findings. Additionally, the study demonstrated a heightened occurrence of AMI among hypertensive individuals, mirroring our observation that anterior wall MI is particularly prevalent in hypertensive patients.

In contrast to our study, a Swedish,[12] study boasted a larger cohort, exceeding 80,000 participants. The mean

age of their cohort was 70 years, diverging from our study's mean age of 61 years. 22% of the Swedish participants were current smokers, while 56% presented with hypertension, 26% with hyperlipidemia, and 22% with diabetes. In contrast, our study observed a higher prevalence of hypertension (70%), diabetes (53%), and current smoking (56%) among participants. The Swedish study further subdivided its participants into four subsets based on left ventricular ejection fraction (LVEF), whereas our study grouped patients into three LVEF categories. Left ventricular systolic dysfunction or pulmonary congestion manifests in 13–32% of myocardial infarction cases and correlates with a two to threefold elevated risk of subsequent mortality or hospitalization due to heart failure. In our study, 55% exhibited LVEF less than 40%, 39% displayed LVEF between 41% and 55%, and 6% presented LVEF ranging from 55% to 70%.

In our research, the patient data highlights the prevalence of hypertension, diabetes, and smoking among patients with acute MI. These comorbidities have been recognized as important factors in determining left ventricular ejection fraction (LVEF) and clinical outcomes in patients with MI, as discussed by Marco Giuseppe Del Buono.[13] Factors such as microvascular dysfunction, inflammation, and neurohormonal imbalance mentioned in their study may contribute to heart failure following MI, which could explain the varying LVEF values observed in our study.

A study conducted in Indonesia,[14] investigated the association between smoking and hypertension, revealing a robust correlation akin to our findings. Consistent with societal norms, a greater proportion of male participants were observed to engage in smoking compared to females in our study. Smoking emerged as a significant modifiable risk factor associated with hypertension. These results underscore the imperative of implementing measures aimed at curtailing smoking prevalence to mitigate the risk of hypertension and its associated complications.

2 different studies conducted by Zhijun lei,[15] and Ibrahim Yildiz,[16] discuss predictors of LVEF decline and the significance of LVEF trajectories in risk stratification and prognosis in patients with MI. Our study also provides insights into the distribution of LVEF values among different subgroups based on demographics and comorbidities. This information aligns with the importance of monitoring LVEF trajectories and recognizing predictors of LVEF decline to optimize outcomes in MI patients.

Steele C Butcher,[17] and his colleagues investigated the prognostic significance of the left ventricular global work index in patients with STEMI and reduced LVEF. They concluded that higher values of the left ventricular global work index were associated with a greater probability of LVEF normalization at follow-up and lower values were independently associated with high mortality at long-term follow-up. Their demographic analysis revealed that the mean age of the study participants closely mirrored that of our study, at 61 years. Furthermore, 75% of their participants identified as male, a figure slightly higher than our study's 69% male representation. In terms of comorbidities, 37% of their cohort reported hypertension, contrasting with the higher prevalence of 70% observed in our study. Similarly, 15% of their participants were diabetic, which is notably lower than the 53% prevalence noted in our study.

The Japanese,[18] study reported that merely 14% of their acute myocardial infarction (MI) patients exhibited left ventricular ejection fraction (LVEF) values below 35%. Conversely, our investigation demonstrated that 55% of patients presented with LVEF ranging from 25% to 40%. The prevalence of hypertension is elevated in patients with diabetes, approximately double that of individuals without diabetes.[19] Our study corroborates this finding, emphasizing the importance of enhancing awareness surrounding diabetes and its associated complications. Given the documented low awareness levels, as highlighted by Faiza Batool and colleagues,[20] concerted efforts are warranted to mitigate cardiovascular morbidity and mortality through targeted interventions aimed at diabetes management and prevention.

Overall, these studies contribute to the understanding of left ventricular dysfunction after AMI and provide insights into risk stratification, prognosis, and management strategies. Early recognition, appropriate interventions, and comprehensive assessments are crucial for improving outcomes in patients with left ventricular dysfunction post-AMI.

Limitations of the study include potential selection bias, limited sample size, and the single-centre nature of the research, which may affect generalizability.

Missing data or loss of follow-up may also impact the analysis and interpretation of results.

The findings from this research aim to contribute valuable insights into the incidence and factors

associated with acute left ventricular dysfunction in patients with acute myocardial infarction, potentially guiding future clinical interventions and management strategies.

5. Conclusion

This study provides insights into the demographics, medical conditions, changes in ejection fraction, and location of MI among patients presenting with acute MI. The findings highlight important differences between genders and reveal associations between hypertension, diabetes, smoking, EF, and the location of the MI. Future research should focus on elucidating the underlying mechanisms driving these associations and exploring potential interventions to improve outcomes in acute MI patients.

INSTITUTIONAL REVIEW BOARD

00291116MMANA Dated 30-11-2016

CONFLICTS OF INTEREST- None

Financial support: None to report.
Potential competing interests: None to report

Contributions:
K.M, F.B, S.S, L.M - Conception of study
K.M, F.B, S.S - Experimentation/Study Conduction
K.M, F.B, S.S - Analysis/Interpretation/Discussion
K.M, F.B, S.S - Manuscript Writing
K.M, F.B, S.S, L.M - Critical Review

All authors approved the final version to be published & agreed to be accountable for all aspects of the work.

References

1. Jenča D, Melenovský V, Stehlik J, Staněk V, Kettner J, Kautzner J, et al. Heart failure after myocardial infarction: incidence and predictors. ESC heart failure. 2021 Feb;8(1):222-37. https://doi.org/10.1002/ehf2.13144
2. Bajaj A, Sethi A, Rathor P, Suppogu N, Sethi A. Acute Complications of Myocardial Infarction in the Current Era: Diagnosis and Management. Journal of Investigative Medicine. 2015;63(7):844-855. https://doi.org/10.1097/JIM.0000000000000232
3. Silbiger JJ. Pathophysiology and echocardiographic diagnosis of left ventricular diastolic dysfunction. Journal of the American Society of Echocardiography. 2019 Feb 1;32(2):216-32. https://doi.org/10.1016/j.echo.2018.11.011
4. Fishbein GA, Fishbein MC, Wang J, Buja LM. Myocardial ischemia and its complications. InCardiovascular pathology 2022 Jan 1 (pp. 407-445). Academic Press. https://doi.org/10.1016/B978-0-12-822224-9.00022-0
5. Leancă SA, Crișu D, Petriș AO, Afrăsânie I, Genes A, Costache AD, et al. Left ventricular remodeling after myocardial infarction: from physiopathology to treatment. Life. 2022 Jul 24;12(8):1111. https://doi.org/10.3390/life12081111
6. De Luca L. Established and emerging pharmacological therapies for post-myocardial infarction patients with heart failure: a review of the evidence. Cardiovascular Drugs and Therapy. 2020 Oct;34(5):723-35. https://doi.org/10.1007/s10557-020-07027-4
7. Beerkens FJ, Claessen BE, Mahan M, Gaudino MF, Tam DY, Henriques JP, et al. Contemporary coronary artery bypass graft surgery and subsequent percutaneous revascularization. Nature Reviews Cardiology. 2022 Mar;19(3):195-208. https://doi.org/10.1038/s41569-021-00612-6
8. Rossello X, Ariti C, Pocock SJ, Ferreira JP, Girerd N, McMurray JJ, et al. Impact of mineralocorticoid receptor antagonists on the risk of sudden cardiac death in patients with heart failure and left-ventricular systolic dysfunction: an individual patient-level meta-analysis of three randomized-controlled trials. Clinical research in cardiology. 2019 May 1;108:477-86. https://doi.org/10.1007/s00392-018-1378-0
9. Choi AJ, Thomas SS, Singh JP. Cardiac resynchronization therapy and implantable cardioverter defibrillator therapy in advanced heart failure. Heart failure clinics. 2016 Jul 1;12(3):423-36. https://doi.org/10.1016/j.amjcard.2016.11.043
10. Khaled S, Matahen R. Cardiovascular risk factors profile in patients with acute coronary syndrome with particular reference to left ventricular ejection fraction. Indian heart journal. 2018 Jan 1;70(1):45-9. doi: 10.1016/j.ihj.2017.05.019
11. Menhas S, Shehryar M, Saad M, Afridi A, Ali N, Khan A, et al. Distribution of Myocardial Infarction Regarding Hypertensive, Diabetes and Gender. Pakistan Journal of Medical & Health Sciences. 2022;16(12):667-. https://doi.org/10.53350/pjmhs20221612667
12. Hamilton E, Desta L, Lundberg A, Alfredsson J, Christersson C, Erlinge D, Kellerth T, Lindmark K, Omerovic E, Reitan C, Jernberg T. Prevalence and prognostic impact of left ventricular systolic dysfunction or pulmonary congestion after acute myocardial infarction. ESC Heart Failure. 2023 Apr;10(2):1347-57. https://doi.org/10.1002/ehf2.14301
13. Del Buono MG, Garmendia CM, Seropian IM, Gonzalez G, Berrocal DH, Biondi-Zoccai G, et al. Heart Failure After ST-Elevation Myocardial Infarction: Beyond Left Ventricular Adverse Remodeling. Curr Probl Cardiol. 2023Aug;48(8):101215. https://doi.org/10.1016/j.cpcardiol.2022.101215
14. Lusno MF. Association Between Smoking and Hypertension as Health Burden in Sidoarjo: A Case-Control Study. International Journal of Applied Biology. 2020;4(2)):9-16. https://doi.org/10.20956/ijab.v4i(2).10951
15. Lei Z, Li B, Li B, Peng W. Predictors and prognostic impact of left ventricular ejection fraction trajectories in patients with ST-segment elevation myocardial infarction. Aging Clinical and Experimental Research. 2022 Jun;34(6):1429-38. DOI: 10.1007/s40520-022-02087-y
16. Yildiz I, Rencüzoğulları I, Karabağ Y, Karakayali M, Artac I, Gurevin MS. Predictors of left ventricular ejection function decline in young patients with ST-segment elevation

myocardial infarction. Revista da Associação Médica Brasileira. 2022 Jun 24;68:802-7. https://doi.org/10.1590/1806-9282.20220033
17. Butcher SC, Lustosa RP, Abou R, Marsan NA, Bax JJ, Delgado V. Prognostic implications of left ventricular myocardial work index in patients with ST-segment elevation myocardial infarction and reduced left ventricular ejection fraction. European Heart Journal-Cardiovascular Imaging. 2022 May 1;23(5):699-707. https://doi.org/10.1093/ehjci/jeab096
18. Hanada K, Sasaki S, Seno M, Kimura Y, Ichikawa H, Nishizaki F, et al. Reduced Left Ventricular Ejection Fraction Is a Risk for Sudden Cardiac Death in the Early Period After Hospital Discharge in Patients With Acute Myocardial Infarction. Circulation Journal. 2022 Sep 22;86(10):1490-8.
19. https://doi.org/10.1253/circj.CJ-21-0999
20. Petrie JR, Guzik TJ, Touyz RM. Diabetes, hypertension, and cardiovascular disease: clinical insights and vascular mechanisms. Canadian Journal of Cardiology. 2018 May 1;34(5):575-84. doi: 10.1016/j.cjca.2017.12.005
21. Batool F, Malik K, Meraj L, Siddiq S, Majeed A, Khan S. Awareness About Diabetes And Its Complications Among Patients With Diabetes Mellitus . JRMC. 2023 Dec. 30;27(4):664-69 https://www.journalrmc.com/index.php/JRMC/article/view/2381