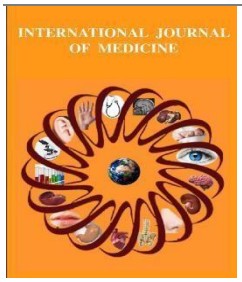
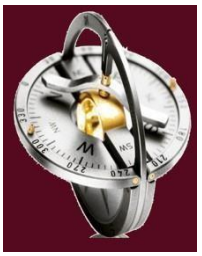


International Journal of Medicine
ISSN (P): 1468-3814; ISSN (e): 2667-7008
https://theinternationalmedicine.com/



Volume: 7(1) 2025

Original Research Article

Combined Assessment of Left Ventricular End Diastolic Pressure (Lvedp) And Left Ventricular Ejection Fraction (Lvef) In Predicting Clinical Outcomes Up to One Year in Patients Undergoing Primary Angioplasty

Dr. Saroj Soni[1], Dr. Subhashis Chakraborty[2], Dr. Hema Malathi[3], Dr. Debarshi Jana[4]
[1]RMO/Clinical Tutor, Department of Cardiology, Super Speciality Wing(Anamoy) Hospital, Bardhaman, West Bengal 713103 & Burdwan Medical College & Hospital, Bardhaman, West Bengal 713104.
[2]RMO cum Clinical Tutor, Department of Cardiology, Nil Ratan Sarkar Medical College and Hospital, Kolkata, West Bengal 700014
[3]Assistant Professor, Department of Cardiology, Nil Ratan Sarkar Medical College and Hospital, Kolkata, West Bengal 700014
[4]PhD (Cal), Biostatistics and Epidemiology (IBRI), Consultant Biostatistician and Epidemiologist, Young Scientist (Associate Professor), Department of Science & Technology, Government of India, IPGMER and SSKM Hospital, Ekbalpur, Kolkata, West Bengal 700023.

Abstract

Introduction: Primary percutaneous coronary intervention (PCI), also known as primary angioplasty is the gold standard for the treatment of acute myocardial infarction (MI). Early and successful revascularization improves survival and reduces morbidity in patients with acute ST-elevation myocardial infarction (STEMI). ***Aims***: To evaluate the combined role of Left Ventricular End-Diastolic Pressure (LVEDP) and Left Ventricular Ejection Fraction (LVEF) in predicting clinical outcomes in patients undergoing primary angioplasty. ***Materials & Methods***: This prospective cohort study was conducted in the Department of Cardiology, Nilratan Sircar Medical College and Hospital, Kolkata, a tertiary care teaching hospital, from February 2023 to September 2024, and included 288 patients presenting with cardiovascular symptoms and clinical features. ***Result***: In patients with diabetes mellitus, 72 (32.0%) had LVEDP <21 mmHg and 23 (36.5%) had ≥21 mmHg (p = 0.879). Among hypertensive patients, 103 (45.8%) had LVEDP <21 mmHg and 28 (44.4%) had ≥21 mmHg (p = 0.851). For participants with dyslipidaemia, 153 (68.0%) had LVEDP <21 mmHg and 40 (63.5%) had ≥21 mmHg (p = 0.501). ***Conclusion***: We concluded that predicting clinical outcomes for patients undergoing primary angioplasty, the combined measurement of left ventricular end-diastolic pressure (LVEDP) and left ventricular ejection fraction (LVEF) offers substantial predictive value. According to the study, major adverse cardiovascular events (MACE), heart failure, and death were higher in patients with LVEF ≤40% than in those with higher LVEF.

Keywords: LVEF, Mortality, Myocardial Infarction, Stroke and Echocardiography.

Introduction:

The widespread use of digital devices has transformed the daily routines Primary percutaneous coronary intervention (PCI), also known as primary angioplasty, is the gold standard for the treatment of acute myocardial infarction (MI). Early and successful revascularization improves survival and reduces morbidity in patients with acute ST-elevation myocardial infarction (STEMI) [1]. However, despite advancements in PCI, a significant proportion of patients experience poor clinical outcomes, including heart failure, recurrent myocardial infarction and mortality [2].Left ventricular ejection fraction (LVEF) and left ventricular end-diastolic pressure (LVEDP) are two critical hemodynamic markers used to assess left ventricular function and predict patient prognosis. LVEF is a widely recognized predictor of long-term survival in patients with coronary artery disease (CAD) and those undergoing PCI [3]. A reduced LVEF is associated with an increased risk of adverse outcomes such as heart failure, arrhythmias and death [4]. LVEDP, which reflects the preload status and diastolic function of the left ventricle, has also been shown to be a significant predictor of clinical outcomes, especially in heart failure patients [5]. Elevated LVEDP is linked to poor outcomes, including hospital readmissions and increased mortality. Despite the known prognostic value of both LVEF and LVEDP, the combined assessment of these two parameters in predicting clinical outcomes post-primary angioplasty remains underexplored. This study aims to investigate the utility of the combined assessment of LVEF and LVEDP in predicting clinical outcomes, such as mortality, recurrent myocardial infarction and heart failure, in patients undergoing primary angioplasty. By correlating these hemodynamic parameters with clinical outcomes over a one-year period, this study aims to identify reliable predictors of long-term prognosis in this high-risk patient population. Furthermore, previous studies have shown that integrating multiple hemodynamic parameters enhances the accuracy of outcome prediction. Therefore, evaluating the combination of LVEF and LVEDP could provide a more comprehensive risk stratification model to better guide clinical decision-making in post-angioplasty care. Study aims to evaluate the combined role of Left Ventricular End-Diastolic Pressure (LVEDP) and Left Ventricular Ejection Fraction (LVEF) in predicting clinical outcomes in patients undergoing primary angioplasty.

Address for Correspondence: Dr. Hema Malathi, Assistant Professor, Department of Cardiology, Nil Ratan Sarkar Medical College and Hospital, Kolkata, West Bengal 700014

DOI: 10.5455/im.974554

MATERIALS AND METHODS

Type of Study: A prospective cohort study
Place of Study: Department of Cardiology, Nilratan Sircar Medical College and Hospital, Kolkata. The Institution serves as the tertiary care teaching hospital.
Study Duration: From February 2023 to September 2024.
Sample Size: 288 patients

Inclusion Criteria:

- Age: 18-80 years.
- Undergoing primary angioplasty for acute myocardial infarction (MI) or other coronary artery disease (CAD) indications.

- Documented coronary artery disease (CAD) confirmed through coronary angiography, stress tests or non-invasive imaging.
- Measurable Left Ventricular Ejection Fraction (LVEF) via echocardiography, MRI, or other imaging modalities.

Exclusion Criteria:

- Age below 18 or above 80 years.
- Non-primary angioplasty patients, including those undergoing repeat angioplasty or coronary artery bypass grafting (CABG).
- Non-documented coronary artery disease (CAD) (e.g., patients without confirmatory angiographic or imaging evidence of CAD).
- Unmeasurable LVEF.

Study Variables:

- Left Ventricular End-Diastolic Pressure (LVEDP)
- Left Ventricular Ejection Fraction (LVEF)
- Mortality at 1-year follow-up.
- Myocardial Infarction (MI) recurrence within one year.

Statistical Analysis:

Data were entered into Excel and subsequently analyzed using SPSS and GraphPad Prism. Continuous variables were summarized as means with standard deviations, while categorical variables were presented as counts and percentages. Comparisons between independent groups were performed using two-sample t-tests, and paired t-tests were applied for correlated (paired) data. Categorical data were compared using chi-square tests, with Fisher's exact test applied when expected cell counts were small. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

Table 1: Distribution of the groups.

Groups	Frequency	Percentage
I	89	30.90%
II	65	22.60%
III	74	25.70%
IV	5	1.70%
V	12	4.20%
VI	43	14.90%
Total	288	100%

Table 2: Age distribution, Gender, diabetes mellitus and dyslipidaemia

		Frequency	Percentage
Age	21 – 30	2	0.70%
	31 – 40	16	5.60%
	41 – 50	57	19.80%
	51 – 60	85	29.50%
	61 – 70	88	30.60%
	71 – 80	33	11.50%
	81 – 90	7	2.40%
	Total	288	100%
Gender	Males	228	79.20%
	Females	60	20.80%
	Total	288	100%
Diabetes mellitus	Yes	135	46.90%
	No	153	53.10%
	Total	288	100.00%
Dyslipidaemia	Yes	95	33.00%
	No	193	67.00%
	Total	288	100%

Table 3: Prevalence of hypertension

	Frequency	Percentage
Hypertension	131	45.50%
Non - Hypertension	157	54.50%
Total	288	100%

Table 4: Distribution of Mean heart, Systolic BP, Diastolic BP on admission

	Groups	N	Mean	Min	Max	P- value
Heart rate	I	89	78.63 ± 19.26	Min	Max	0.002
	II	65	81.00 ± 17.18	30	130	
	III	74	84.88 ± 18.90	36	126	
	IV	5	72.40 ± 12.38	47	123	
	V	12	89.00 ± 26.17	58	86	
	VI	43	92.84 ± 22.78	58	130	
Systolic BP	I	89	147.07 ± 29.44	100	224	0.186
	II	65	151.31 ± 36.07	80	250	
	III	74	145.04 ± 37.35	70	240	
	IV	5	161.60 ± 35.41	127	206	
	V	12	162.58 ± 42.20	100	220	
	VI	43	137.71 ± 36.42	80	230	
Diastolic BP	I	89	87.93 ± 17.36	52	143	0.614
	II	65	90.42 ± 20.64	54	150	
	III	74	89.23 ± 21.58	40	172	
	IV	5	93.00 ± 23.34	70	130	
	V	12	94.75 ± 26.66	59	146	
	VI	43	84.72 ± 21.30	40	140	

Table 5: Association between LVEF and various comorbidities

		≥ 50%	41 – 49%	≤ 40%	P -value
LVEF and various comorbidities	Diabetes Mellitus	47 (50.0%)	41 (53.2%)	47 (40.2%)	0.154
	Hypertension	42 (44.7%)	37 (48.1%)	52 (44.4%)	0.869
	Dyslipidaemia	28 (29.8%)	29 (37.7%)	38 (32.5%)	0.546
	Age > 50 years	71 (75.5%)	50 (64.9%)	92 (78.6%)	0.095

Table 6: Association between LVEDP and various comorbidities.

		<21 (%)	≥21 (%)	P -value
LVEDP and various comorbidities	Diabetes Mellitus	72 (32.0%)	23 (36.5%)	0.879
	Hypertension	103 (45.8%)	28 (44.4%)	0.851
	Dyslipidaemia	153 (68.0%)	40 (63.5%)	0.501
	Age > 50 years	167 (74.2%)	46 (73.0%)	0.847

Table 7: Distribution of Killip class

Killip Class	I	II	III	IV	V	VI	Total
1	32 (36.0%)	13 (20.0%)	17 (23.0%)	1 (20.0%)	2 (16.7%)	8 (11.6%)	70 (24.3%)
2	40 (44.9%)	30 (46.2%)	36 (50.0%)	3 (60.0%)	5 (41.7%)	16 (37.2%)	131 (45.5%)
3	11 (12.4%)	21 (32.3%)	16 (21.6%)	1 (20.0%)	5 (41.7%)	14 (32.6%)	68 (23.6%)
4	6 (6.7%)	1 (1.5%)	4 (5.4%)	0 (0.0%)	0 (0.0%)	8 (18.6%)	19 (6.6%)
Total	89	65	74	5	12	43	288

Table 8: Number of coronary vessels involved

No of vessels	1	2	3	4	5	6	Total
Single vessel disease(SVD)	28(28.9%)	23(23.7%)	23(23.7%)	2 (2.1%)	6(6.2%)	15(15.5%)	97(33.60%)
Double vessel disease(DVD)	30(28.8%)	25(24.0%)	31(29.8%)	0 (0.0%)	4(3.8%)	14(13.5%)	104(36.10%)
Triple vessel disease(TVD)	31(35.6%)	17(19.5%)	20(23.0%)	3 (3.4%)	2(2.3%)	14(16.1%)	87(30.20%)
Total	89(30.9%)	65(22.6%)	74(25.7%)	5(1.70%)	12(4.2%)	43(14.9%)	288(100%)

Table 9: Symptoms to balloon time

	Groups	N	Mean	Min	Max	P- value
Symptoms to balloon time	I	89	109.87 ± 93.14	12	745	0.928
	II	65	118.15 ± 176.99	30	1180	
	III	74	120.54 ± 125.99	10	820	
	IV	5	94.20 ± 30.21	50	125	
	V	12	140.58 ± 213.61	37	815	
	VI	43	102.79 ± 26.35	50	180	

Table 10: ECG findings in the study groups

ECG findings	1	2	3	4	5	6	Total
AWMI	31 (34.8%)	33 (50.8%)	56(75.7%)	0(0%)	9(75.0%)	38(88.4%)	167(57.90%)
IWMI	58 (65.2%)	32 (49.2%)	18(24.3%)	5(100%)	3(25.0%)	5 (11.6%)	121(42.10%)
Total	89 (30.9%)	65 (22.6%)	74(25.7%)	5 (1.7%)	12(4.2%)	43 (14.9%)	288 (100)

Table 11: Access site for CAG and/or PTCA

Access site	Frequency	Percentage
RRA	235	81.60%
LDRA	8	2.80%
RFA	39	13.50%
RFA TO RRA	6	2.10%
Total	288	100%

Table 12: Mean LVSV, LVEDV, LVESV among the study groups

	Groups	N	Mean	Min	Max	P- value
LVSV	I	8	35.58 ± 9.01	13	69	<0.0001
	II	65	28.33 ± 9.64	16	62	
	III	74	24.80 ± 10.95	13	60	
	IV	5	38.08 ± 13.32	25.4	59	
	V	12	30.32 ± 12.14	16	56	
	VI	43	23.09 ± 11.73	12	60	
LVEDV	I	89	97.76 ± 27.21	54	223	0.003
	II	65	98.48 ± 27.21	36	173	
	III	74	109.59 ± 27.56	48	179	
	IV	5	93.00 ± 14.78	79	110	
	V	12	103.08 ± 32.77	48	164	
	VI	43	117.35 ± 104.03	41	245	
LVESV	I	89	49.26 ± 22.77	18	167	<0.0001
	II	65	54.17 ± 22.67	17	167	
	III	74	65.46 ± 23.27	15	131	
	IV	5	35.80 ± 9.88	23	50	
	V	12	54.17 ± 24.48	20	108	

	VI	43	71.77 ± 34.54	18	164	

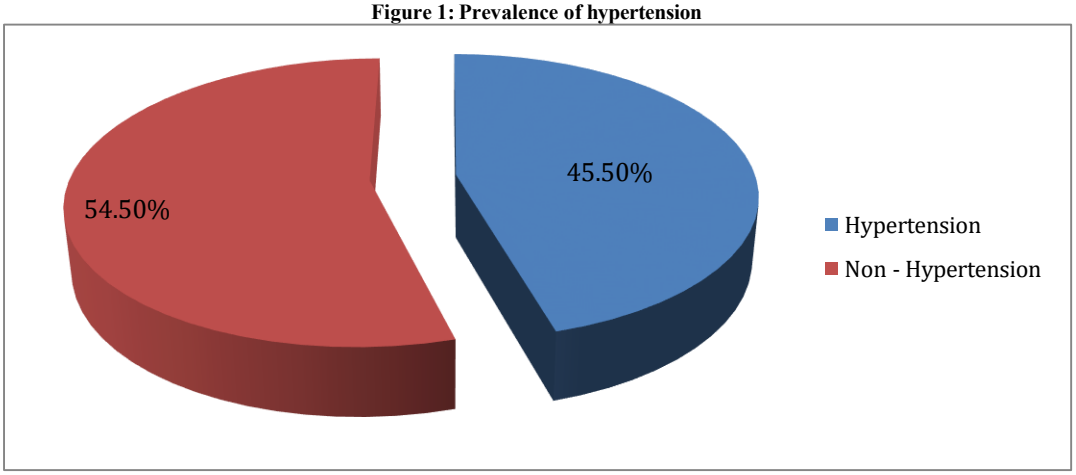
Table 13: Relation between MACE during the hospital stay and LVEF, one month and LVEF and one year and LVEF

		≥ 50%	41 – 49%	≤ 40%	P -value
Hospital stay and LVEF	Death	0 (0.0%)	0 (0%)	8 (6.8%)	0.001
	MI	2 (2.1%)	1 (1.3%)	3 (2.6%)	1
	HF	0 (0%)	0 (0%)	1 (0.9%)	1
	CVA/PVD/CKD	0 (0%)	2 (2.6%)	2 (1.7%)	0.306
	MACE	2 (2.1%)	3 (3.9%)	14 (12.0%)	0.009
One month and LVEF	Death	0 (0%)	0 (0%)	2 (1.7%)	0.341
	MI	1 (1.1%)	1 (1.3%)	3 (2.6%)	0.857
	HF	2 (2.1%)	3 (3.9%)	14 (12.0%)	0.009
	CVA/PVD/CKD	3 (3.2%)	1 (1.3%)	4 (3.4%)	0.737
	MACE	6 (6.4%)	5 (6.5%)	23 (19.7%)	0.003
One year and LVEF	Death	4 (4.3%)	2 (2.6%)	7 (6.0%)	0.558
	MI	2 (2.1%)	2 (2.6%)	5 (4.3%)	0.693
	HF	1 (1.1%)	3 (3.9%)	11 (9.4%)	0.022
	CVA/PVD/CKD	3 (3.2%)	4 (5.2%)	9 (7.7%)	0.398
	MACE	10 (10.6%)	11 (14.3%)	32 (27.4%)	0.004

Table 14: Relation between MACE during the hospital stay and LVEDP, one month and LVEDP and one year and LVEDP

		<21 (%)	≥21 (%)	P- value
Hospital stay and LVEDP	Death	2 (0.9%)	6 (9.5%)	0.002
	MI	5 (2.3%)	1 (1.6%)	1
	HF	1 (0.4%)	0 (0.0%)	1
	CVA/PVD/CKD	3 (1.3%)	1 (1.6%)	1
	MACE	11 (4.9%)	8 (12.7%)	0.041
One month and LVEDP	Death	1 (0.4%)	1 (1.6%)	0.39
	MI	3 (1.3%)	2 (3.2%)	0.301
	HF	9 (4.0%)	10 (15.9%)	0.002
	CVA/PVD/CKD	5 (2.2%)	3 (4.8%)	0.379
	MACE	18 (8.0%)	16 (25.4%)	0.000
One year and LVEDP	Death	8 (3.6%)	5 (7.9%)	0.167
	MI	7 (3.1%)	2 (3.2%)	0.622
	HF	8 (3.6%)	7 (11.1%)	0.025
	CVA/PVD/CKD	12 (5.3%)	4 (6.3%)	0.478
	MACE	35 (15.6%)	18 (28.6%)	0.018

Figure 1: Prevalence of hypertension



In our study population was distributed across six groups. Group I had the highest representation with 89 participants (30.9%), followed by Group III with 74 participants (25.7%) and Group II with 65 participants (22.6%). Group VI included 43 participants (14.9%), while Groups V and IV had the lowest frequencies, with 12 (4.2%) and 5 participants (1.7%), respectively. Overall, a total of 288 participants were included in the study. The study included a total of 288 participants. The age distribution was as follows: 21–30 years – 2 patients (0.7%), 31–40 years – 16 patients (5.6%), 41–50 years – 57 patients (19.8%), 51–60 years – 85 patients (29.5%), 61–70 years – 88 patients (30.6%), 71–80 years – 33 patients (11.5%), and 81–90 years – 7 patients (2.4%). In terms of gender, 228 patients (79.2%) were male and 60 patients (20.8%) were female. Regarding comorbidities, 135 patients (46.9%) had diabetes mellitus while 153 patients (53.1%) did not. Dyslipidaemia was present in 95 patients (33%) and absent in 193 patients (67%). Among the 288 participants, 131 patients (45.5%) had hypertension, whereas 157 patients (54.5%) did not have hypertension. The mean heart rate among the study groups showed variation. Group I had a mean ± SD of 78.63 ± 19.26 bpm, Group II 81.00 ± 17.18 bpm, Group III 84.88 ± 18.90 bpm, Group IV 72.40 ± 12.38 bpm, Group V 89.00 ± 26.17 bpm, and Group VI 92.84 ± 22.78 bpm. The differences in heart rate between groups were statistically significant ($p = 0.002$). The mean systolic blood pressure (BP) across the study groups varied as follows: Group I – 147.07 ± 29.44 mmHg, Group II – 151.31 ± 36.07 mmHg, Group III – 145.04 ± 37.35 mmHg, Group IV – 161.60 ± 35.41 mmHg, Group V – 162.58 ± 42.20 mmHg, and Group VI – 137.71 ± 36.42 mmHg. The differences in systolic BP among the groups were not statistically significant ($p = 0.186$). The mean diastolic blood pressure (BP) among the study groups was as follows: Group I – 87.93 ± 17.36 mmHg, Group II – 90.42 ± 20.64 mmHg, Group III – 89.23 ± 21.58 mmHg, Group IV – 93.00 ± 23.34 mmHg, Group V – 94.75 ± 26.66 mmHg, and Group VI – 84.72 ± 21.30 mmHg. There was no statistically significant difference in diastolic BP across the groups ($p = 0.614$). The dist ribution of left ventricular ejection fraction (LVEF) among participants based on comorbidities and age showed no statistically significant differences. Among

patients with diabetes mellitus, 47 (50.0%) had LVEF ≥50%, 41 (53.2%) had 41–49%, and 47 (40.2%) had ≤40% (p = 0.154). In hypertensive patients, 42 (44.7%) had LVEF ≥50%, 37 (48.1%) had 41–49%, and 52 (44.4%) had ≤40% (p = 0.869). Among those with dyslipidaemia, 28 (29.8%) had LVEF ≥50%, 29 (37.7%) had 41–49%, and 38 (32.5%) had ≤40% (p = 0.546). For participants aged >50 years, 71 (75.5%) had LVEF ≥50%, 50 (64.9%) had 41–49%, and 92 (78.6%) had ≤40% (p = 0.095). The distribution of left ventricular end-diastolic pressure (LVEDP) among participants showed no significant differences. In patients with diabetes mellitus, 72 (32.0%) had LVEDP <21 mmHg and 23 (36.5%) had ≥21 mmHg (p = 0.879). Among hypertensive patients, 103 (45.8%) had LVEDP <21 mmHg and 28 (44.4%) had ≥21 mmHg (p = 0.851). For participants with dyslipidaemia, 153 (68.0%) had LVEDP <21 mmHg and 40 (63.5%) had ≥21 mmHg (p = 0.501). In those aged >50 years, 167 (74.2%) had LVEDP <21 mmHg and 46 (73.0%) had ≥21 mmHg (p = 0.847). The distribution of Killip class across the six groups showed that Killip class II was the most common, observed in 131 patients (45.5%), followed by class I in 70 patients (24.3%) and class III in 68 patients (23.6%). Killip class IV was the least frequent, seen in 19 patients (6.6%). The proportions varied among the groups, with Group II having the highest number of patients in class II (30, 46.2%) and Group VI showing a notable proportion in class IV (8, 18.6%).The distribution of coronary artery disease based on the number of vessels involved showed that double vessel disease (DVD) was the most common, observed in 104 patients (36.1%), followed by single vessel disease (SVD) in 97 patients (33.6%) and triple vessel disease (TVD) in 87 patients (30.2%). The frequency of involvement varied across the six groups, with Group I having the highest number of patients with TVD (31, 35.6%), Group II showing a predominance of DVD (25, 24.0%), and Group III having nearly equal distribution among SVD (23, 23.7%) and DVD (31, 29.8%).The mean symptoms-to-balloon time among the study groups was as follows: Group I – 109.87 ± 93.14 minutes, Group II – 118.15 ± 176.99 minutes, Group III – 120.54 ± 125.99 minutes, Group IV – 94.20 ± 30.21 minutes, Group V – 140.58 ± 213.61 minutes, and Group VI – 102.79 ± 26.35 minutes. There was no statistically significant difference in symptoms-to-balloon time across the groups (p = 0.928). The mean symptoms-to-balloon time for the study groups was: Group I – 109.87 ± 93.14 minutes, Group II – 118.15 ± 176.99 minutes, Group III – 120.54 ± 125.99 minutes, Group IV – 94.20 ± 30.21 minutes, Group V – 140.58 ± 213.61 minutes, and Group VI – 102.79 ± 26.35 minutes. The differences among the groups were not statistically significant (p = 0.928). The distribution of ECG findings among the study groups showed that anterior wall myocardial infarction (AWMI) was more common, observed in 167 patients (57.9%), while inferior wall myocardial infarction (IWMI) was seen in 121 patients (42.1%). The prevalence of AWMI was highest in Group VI (38, 88.4%) and Group III (56, 75.7%), whereas IWMI predominated in Group IV (5, 100%) and Group I (58, 65.2%).Among the 288 participants, the most common access site for the procedure was the right radial artery (RRA), used in 235 patients (81.6%). Right femoral artery (RFA) access was used in 39 patients (13.5%), left distal radial artery (LDRA) in 8 patients (2.8%), and crossover from RFA to RRA was required in 6 patients (2.1%).The mean left ventricular stroke volume (LVSV) varied across the study groups as follows: Group I – 35.58 ± 9.01 mL, Group II – 28.33 ± 9.64 mL, Group III – 24.80 ± 10.95 mL, Group IV – 38.08 ± 13.32 mL, Group V – 30.32 ± 12.14 mL, and Group VI – 23.09 ± 11.73 mL. The differences in LVSV among the groups were statistically significant (p = 0.000). The mean left ventricular end-diastolic volume (LVEDV) across the study groups was: Group I – 97.76 ± 27.21 mL, Group II – 98.48 ± 27.21 mL, Group III – 109.59 ± 27.56 mL, Group IV – 93.00 ± 14.78 mL, Group V – 103.08 ± 32.77 mL, and Group VI – 117.35 ± 104.03 mL. The differences in LVEDV among the groups were statistically significant (p = 0.003). The mean left ventricular end-systolic volume (LVESV) across the study groups was: Group I – 49.26 ± 22.77 mL, Group II – 54.17 ± 22.67 mL, Group III – 65.46 ± 23.27 mL, Group IV – 35.80 ± 9.88 mL, Group V – 54.17 ± 24.48 mL, and Group VI – 71.77 ± 34.54 mL. The differences in LVESV among the groups were statistically significant (p = 0.000). The analysis of outcomes based on left ventricular ejection fraction (LVEF) showed that deaths occurred only in patients with LVEF ≤40% (8, 6.8%), with a statistically significant difference (p = 0.001). Myocardial infarction (MI) occurred across all LVEF categories: ≥50% – 2 (2.1%), 41–49% – 1 (1.3%), ≤40% – 3 (2.6%) (p = 1.0). Heart failure (HF) was reported in 1 patient (0.9%) with LVEF ≤40% (p = 1.0). Cerebrovascular accident (CVA), peripheral vascular disease (PVD), or chronic kidney disease (CKD) occurred in 4 patients, distributed as 2 (2.6%) in 41–49% and 2 (1.7%) in ≤40% (p = 0.306). Major adverse cardiovascular events (MACE) were significantly higher in patients with LVEF ≤40% (14, 12.0%) compared to 2 (2.1%) in ≥50% and 3 (3.9%) in 41–49% (p = 0.009). The analysis of outcomes based on left ventricular ejection fraction (LVEF) showed that deaths occurred in 2 patients (1.7%) with LVEF ≤40%, with no statistically significant difference (p = 0.341). Myocardial infarction (MI) was observed in 1 (1.1%) patient with LVEF ≥50%, 1 (1.3%) with 41 – 49%, and 3 (2.6%) with ≤40% (p = 0.857). Heart failure (HF) was significantly higher in patients with LVEF ≤40% (14, 12.0%) compared to 2 (2.1%) in ≥50% and 3 (3.9%) in 41–49% (p = 0.009). Cerebrovascular accident (CVA), peripheral vascular disease (PVD), or chronic kidney disease (CKD) occurred in 3 (3.2%) with LVEF ≥50%, 1 (1.3%) with 41–49%, and 4 (3.4%) with ≤40% (p = 0.737). Major adverse cardiovascular events (MACE) were significantly more frequent in patients with LVEF ≤40% (23, 19.7%) compared to 6 (6.4%) in ≥50% and 5 (6.5%) in 41 –49% (p = 0.003). The analysis of outcomes according to left ventricular ejection fraction (LVEF) showed that deaths occurred in 4 patients (4.3%) with LVEF ≥50%, 2 patients (2.6%) with 41–49%, and 7 patients (6.0%) with ≤40% (p = 0.558). Myocardial infarction (MI) was observed in 2 (2.1%), 2 (2.6%), and 5 (4.3%) patients across the same LVEF categories, respectively (p = 0.693). Heart failure (HF) was significantly higher in patients with LVEF ≤40% (11, 9.4%) compared to 1 (1.1%) in ≥50% and 3 (3.9%) in 41–49% (p = 0.022). Cerebrovascular accident (CVA), peripheral vascular disease (PVD), or chronic kidney disease (CKD) occurred in 3 (3.2%), 4 (5.2%), and 9 (7.7%) patients, respectively (p = 0.398). Major adverse cardiovascular events (MACE) were significantly more frequent in patients with LVEF ≤40% (32, 27.4%) compared to 10 (10.6%) in ≥50% and 11 (14.3%) in 41–49% (p = 0.004). The outcomes based on left ventricular end-diastolic pressure (LVEDP) showed that deaths were significantly higher in patients with LVEDP ≥21 mmHg (6, 9.5%) compared to 2 (0.9%) in those with LVEDP <21 mmHg (p = 0.002). Myocardial infarction (MI) occurred in 5 (2.3%) with LVEDP <21 and 1 (1.6%) with ≥21 (p = 1.0). Heart failure (HF) was observed in 1 patient (0.4%) with LVEDP <21 mmHg (p = 1.0). Cerebrovascular accident (CVA), peripheral vascular disease (PVD), or chro nic kidney disease (CKD) occurred in 3 (1.3%) with LVEDP <21 and 1 (1.6%) with ≥21 (p = 1.0). Major adverse cardiovascular events (MACE) were significantly higher in patients with LVEDP ≥21 mmHg (8, 12.7%) compared to 11 (4.9%) in those with LVEDP <21 mmHg (p = 0.041). The outcomes based on left ventricular end-diastolic pressure (LVEDP) showed that deaths occurred in 1 patient (0.4%) with LVEDP <21 mmHg and 1 patient (1.6%) with LVED P ≥21 mmHg (p = 0.39). Myocardial infarction (MI) was reported in 3 patients (1.3%) with LVEDP <21 and 2 patients (3.2%) with LVEDP ≥21 (p = 0.301). Heart failure (HF) was significantly higher in patients with LVEDP ≥21 mmHg (10, 15.9%) compared to 9 (4.0%) in those with LVEDP <21 mmHg (p = 0.002). Cerebrovascular accident (CVA), peripheral vascular disease (PVD), or chronic kidney disease (CKD) occurred in 5 (2.2%) with LVEDP <21 and 3 (4.8%) with LVEDP ≥21 (p = 0.379). Major adverse cardiovascular events (MACE) were significantly more frequent in patients with LVED P ≥21 mmHg (16, 25.4%) compared to 18 (8.0%) in those with LVEDP <21 mmHg (p = 0.000). The outcomes based on left ventricular end-diastolic pressure (LVEDP) showed that deaths occurred in 8 patients (3.6%) with LVEDP <21 mmHg and 5 patients (7.9%) with LVEDP ≥21 mmHg (p = 0.167). Myocardial infarction (MI) was reported in 7 patients (3.1%) with LVEDP <21 and 2 patients (3.2%) with LVEDP ≥21 (p = 0.622). Heart failure (HF) was significantly higher in patients with LVEDP ≥21 mmHg (7, 11.1%) compared to 8 (3.6%) in those with LVEDP <21 mmHg (p = 0.025). Cerebrovascular accident (CVA), peripheral vascular disease (PVD), or chronic kidney disease (CKD) occurred in 12 (5.3%) with LVEDP <21 and 4 (6.3%) with LVEDP ≥21 (p = 0.478). Major adverse cardiovascular events (MACE) were significantly more frequent in patients with LVEDP ≥21 mmHg (18, 28.6%) compared to 35 (15.6%) in those with LVEDP <21 mmHg (p = 0.018).

.

DISCUSSION

We showed that this age pattern closely mirrors findings from the INTERHEART study by Yusuf et al. (2004), which demonstrated that the mean age of myocardial infarction (MI) onset in South Asians is around a decade younger than in Western populations [6]. The marked male predominance (79.2%) in our cohort also aligns with data from Gupta et al. (2019) and Ghosh et al. (2020), where men constituted nearly 80% of STEMI presentations, highlighting gender-based differences in cardiovascular risk attributable to hormonal and lifestyle factors [7,8].

We found that Group VI had the highest mean heart rate (92.84 ± 22.78 bpm), followed by Group V (89.00 ± 26.17 bpm), indicating greater sympathetic activation, whereas Group IV showed the lowest heart rate (72.40 ± 12.38 bpm). Systolic BP was highest in Group V (162.58 ± 42.20 mmHg) and Group IV (161.60 ± 35.41 mmHg), while diastolic BP peaked in Group V (94.75 ± 26.66 mmHg), although blood pressure differences were not statistically significant. Killip class distribution showed that Group II had the highest proportion of class II patients (46.2%), whereas Group VI had the highest burden of class IV heart failure (18.6%). Coronary angiography revealed that triple-vessel disease was most frequent in Group I (35.6%), double-vessel disease in Group II (24.0%), and Group III showed nearly equal SVD (23.7%) and DVD (29.8%) involvement. Symptoms-to-balloon time was longest in Group V (140.58 ± 213.61 minutes), while Group IV had the shortest delay (94.20 ± 30.21 minutes). ECG patterns showed that AWMI was most prevalent in Group VI (88.4%) and Group III (75.7%), whereas IWMI was exclusively highest in Group IV (100%). Ventricular parameters showed significant group-wise differences: LVEDV was highest in Group VI (117.35 ± 104.03 mL) and Group III (109.59 ± 27.56 mL); LVESV was highest in Group VI (71.77 ± 34.54 mL) and Group III (65.46 ± 23.27 mL); and LVSV was lowest in Group VI (23.09 ± 11.73 mL). Outcome analysis demonstrated that adverse events were

concentrated in patients with LVEF ≤40%, who recorded the highest mortality (up to 6.8%), heart failure (up to 12.0%), and MACE (up to 27.4%); similarly, elevated LVEDP ≥21 mmHg was associated with higher mortality (up to 9.5%), heart failure (up to 15.9%), and MACE (up to 28.6%).In similar study by Kosmidou et al. (2023) and Maes et al. (2022), who demonstrated that elevated admission heart rate independently predicts higher Killip class and mortality in STEMI patients [9,10]. Although inter-group blood pressure differences were not statistically significant, the higher systolic and diastolic values observed in Groups IV–V align with the observations of Ahmad et al. (2021), who reported that extremes of BP at presentation reflect increased haemodynamic stress [11]. The predominance of Killip IV in Group VI paralleled the greater LVEDV and LVESV with the lowest LVEF, supporting findings by El-Menyar et al. (2020) and Harikrishnan et al. (2019) that higher Killip class is closely linked to ventricular dysfunction and adverse prognosis [12,13]. The strong association of LVEF ≤ 40 % and LVEDP ≥ 21 mmHg with mortality, heart failure, and MACE mirrors the results of Trabattoni et al. (2014), Cioffi et al. (2023), and Morrow et al. (2010), who identified elevated LVEDP as an independent predictor of death and heart-failure hospitalization in post-STEMI patients [14,15].

Conclusion

We concluded that predicting clinical outcomes for patients undergoing primary angioplasty, the combined measurement of left ventricular end-diastolic pressure (LVEDP) and left ventricular ejection fraction (LVEF) offers substantial predictive value. According to the study, major adverse cardiovascular events (MACE), heart failure, and death were higher in patients with LVEF ≤40% than in those with higher LVEF. Similarly, death, heart failure, and MACE were significantly increased in patients with LVEDP ≥21 mmHg. These results emphasize how crucial it is to include both LVEF and LVEDP in risk classification in order to predict unfavorable outcomes. This could lead to more individualized post-angioplasty care and interventions. To investigate possible pathways connecting these factors to unfavorable outcomes, more research may be required.

References

1. Keeley EC, Boura JA, Grines CL. Primary angioplasty versus intravenous thrombolytic therapy for acute myocardial infarction: a quantitative review of 23 randomized trials. Lancet. 2003;361(9351):13-20.
2. Kim HS, Lee JW, Park GM, et al. Prognostic value of left ventricular ejection fraction after percutaneous coronary intervention in patients with acute myocardial infarction. Am Heart J. 2012;163(5):795-803.
3. Hochman JS, Tamis-Holland JE, Agarwal M, et al. Left ventricular ejection fraction and mortality risk after acute myocardial infarction: an overview of 8 randomized trials. JAMA. 2013;310(18):1880-1888.
4. St John Sutton M, Plappert T, White HD, et al. Left ventricular ejection fraction as a predictor of survival after percutaneous coronary intervention in patients with acute myocardial infarction: insights from the THRILL trial. J Am Coll Cardiol. 2003;42(3):473-481.
5. Lang RM, Badano LP, Mor-Avi V, et al. Recommendations for cardiac chamber quantification by echocardiography in adults: an update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging. J Am Soc Echocardiogr. 2015;28(1):1-39.
6. Yusuf S, Hawken S, Ôunpuu 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.
7. Gupta R, Mohan I, Narula J. Trends in coronary heart disease epidemiology in India. J Assoc Physicians India. 2019;67(9):14–7.
8. Ghosh S, Arora R, Gupta R, Chopra HK. Cardiovascular disease in India: a review of current status and future directions. Indian Heart J. 2020;72(1):23–9.
9. Kosmidou I, Mauri L, Kirtane AJ, Witzenbichler B, Stuckey TD, Guagliumi G, et al. Outcomes in patients with STEMI treated with primary PCI and the impact of multivessel disease: insights from the EXAMINATION study. Eur Heart J Acute Cardiovasc Care. 2023;12(3):203–11.
10. Maes F, Venetsanos D, Almalla M, Carrick D, Rioufol G, Tousek P, et al. Radial versus femoral access in acute coronary syndrome: a pooled analysis of contemporary trials. EuroIntervention. 2022;18(2):143–50.
11. Ahmad T, Fiuzat M, Neely B, Neely ML, Felker GM, O'Connor CM, et al. Biomarkers of myocardial stress and fibrosis as predictors of mode of death in patients with chronic heart failure. J Card Fail. 2021;27(9):1054–63.
12. El-Menyar A, Zubaid M, AlHabib KF, Singh R, Sulaiman K, Al-Motarreb A, et al. Mortality trends in acute coronary syndrome in the Middle East: results from the Gulf RACE registry. Am J Emerg Med. 2020;38(8):1623–30.
13. Harikrishnan S, Jeemon P, Mini GK, Thankappan KR, Sylaja PN, Venugopal K, et al. A community-based study on the prevalence and risk factors of coronary artery disease in Kerala, India. Indian Heart J. 2019;71(3):204–11.
14. Trabattoni D, Montorsi P, Fabbiocchi F, Lualdi A, Ravagnani P, Galli S, et al. Early discharge after primary angioplasty: safety and feasibility of a new organizational model. Eur Heart J Acute Cardiovasc Care. 2014;3(4):354–62
15. Cioffi GM, Khan MS, Ahmad T, Patel KV, Vaduganathan M, Fonarow GC, et al. Contemporary epidemiology and outcomes in acute decompensated heart failure. J Am Heart Assoc. 2023;12(9):e029912.