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Original Research Article

Wall Motion Score Index and Left Ventricular Ejection Fraction as Predictors of Cardiovascular Events after Acute Myocardial Infarction

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Abstract

Background: Accurate post-AMI risk stratification is essential for preventing adverse cardiovascular events. Although LVEF is widely used, WMSI may provide additional prognostic value by detecting regional dysfunction.

Aim: To assess and compare the predictive value of WMSI and LVEF in AMI patients for all-cause mortality and rehospitalisation due to heart failure.

Material and Methods: Seventy AMI patients underwent echocardiographic evaluation of LVEF and WMSI during the index admission and were followed for six months. Outcomes of mortality and heart failure rehospitalisation were recorded and analyzed using regression and ROC curve analysis.

Results: Both higher WMSI and lower LVEF were associated with adverse outcomes. WMSI demonstrated incremental predictive power over LVEF, particularly in patients with preserved or mildly reduced LVEF.

Conclusion: WMSI is a complementary prognostic tool alongside LVEF for post-AMI risk stratification. Incorporating both indices enhances prediction of mortality and rehospitalisation, supporting their combined use in clinical practice.

Keywords: Acute myocardial infarction, Wall motion score index, Left ventricular ejection fraction, Prognosis.

Introduction

Acute myocardial infarction (AMI) remains one of the leading causes of morbidity and mortality worldwide despite significant advances in reperfusion therapy and pharmacological management [1]. Accurate risk stratification following AMI is crucial for guiding treatment strategies, optimizing resource allocation, and improving long-term outcomes [2]. Traditionally, left ventricular ejection fraction (LVEF) has been the most widely used index for prognostic evaluation due to its strong association with adverse cardiovascular outcomes, including heart failure and sudden cardiac death [3]. However, LVEF has notable limitations, including dependence on loading conditions, interobserver variability, and its inability to fully capture regional myocardial dysfunction [4].

To address these limitations, the wall motion score index (WMSI) has been proposed as an alternative or complementary tool in assessing left ventricular function. WMSI provides a semi-quantitative measure of regional wall motion abnormalities, which often precede global functional decline and may therefore offer superior prognostic insights in patients with AMI [5]. Several studies have demonstrated that WMSI correlates more closely with infarct size and residual ischemia than LVEF, suggesting that it may be a more sensitive predictor of adverse cardiovascular events [6]. Emerging evidence also suggests that patients with preserved or mildly reduced LVEF may still exhibit significant wall motion abnormalities detectable by WMSI, which contribute to increased risk of post-infarction complications [7]. Furthermore, WMSI has shown incremental prognostic value in predicting heart failure hospitalization and long-term mortality when combined with traditional risk factors and biomarkers [8].

Advances in imaging modalities, particularly echocardiography, have facilitated the routine use of WMSI in clinical practice. Its relative simplicity, non-invasiveness, and reproducibility make it a practical tool for bedside evaluation of patients after AMI [9]. Comparative studies assessing WMSI against LVEF in predicting outcomes such as mortality and readmission due to heart failure are essential to determine the relative utility of these parameters and to optimize prognostic models

in the post-infarction setting [10]. Given the clinical importance of early and accurate risk stratification in AMI patients, this study aims to assess and compare the predictive value of WMSI and LVEF for all-cause mortality and readmission due to heart failure.

Material and Methods

This was a prospective observational study conducted on 70 patients diagnosed with acute myocardial infarction (AMI) and admitted to the coronary care unit. Patients were enrolled consecutively after providing informed consent, and the study was approved by the institutional ethics committee. The inclusion criteria consisted of patients aged 18 years and above with a confirmed diagnosis of AMI based on clinical presentation, electrocardiographic changes, and elevated cardiac biomarkers. Patients with previous history of myocardial infarction, congenital heart disease, valvular abnormalities, cardiomyopathies, or poor echocardiographic window were excluded to avoid confounding factors that might affect left ventricular function assessment.

All participants underwent detailed clinical evaluation, including history, physical examination, and routine laboratory investigations. Standard 12-lead electrocardiography and relevant biochemical tests were performed for diagnostic confirmation. Echocardiographic assessment was carried out within the first week of admission using a standard transthoracic echocardiography system. Left ventricular ejection fraction (LVEF) was measured using the modified Simpson's biplane method from apical two-chamber and four-chamber views, following the recommendations of the American Society of Echocardiography. Wall motion score index (WMSI) was determined by dividing the left ventricle into 16 segments, each scored from 1 to 4 according to the degree of wall motion abnormality, and the sum of the segmental scores was divided by the number of visualized segments.

Patients were followed for a period of six months to document the occurrence of primary endpoints, which included all-cause mortality and readmission due to heart failure. Follow-up was carried out through outpatient visits and telephonic interviews, and hospital records were reviewed in cases of readmission. Statistical analysis was performed using appropriate software. Continuous variables were expressed as mean ± standard deviation, and categorical variables as percentages. Comparative analysis between WMSI and LVEF in predicting outcomes was done using Cox regression models and receiver operating characteristic (ROC) curve analysis. A p-value of less than 0.05 was considered statistically significant.

Results

The baseline characteristics of the study population are presented in Table 1. The mean age of the patients was 52.4 years, with a male predominance. A considerable proportion of patients had associated risk factors such as diabetes mellitus, hypertension, smoking, and renal dysfunction, which reflect the common comorbidities in acute myocardial infarction patients. These baseline variables provide insight into the profile of individuals most vulnerable to adverse cardiovascular events.

The distribution of patients with anterior wall myocardial infarction (AWMI), inferior wall myocardial infarction (IWMI), and non-ST elevation myocardial infarction (NSTEMI) across different LVEF categories is shown in Table 2. It was observed that a higher proportion of patients with AWMI had reduced LVEF compared to those with IWMI and NSTEMI, highlighting the greater adverse impact of anterior wall involvement on left ventricular function. Table 3 demonstrates the distribution of mortality according to WMSI. Mortality was lowest among patients with WMSI ≤1.5, whereas those with WMSI >2.0 had a significantly higher mortality rate, indicating a clear trend of worse outcomes with increasing wall motion abnormalities. Similarly, mortality distribution based on LVEF is presented in Table 4. Patients with preserved LVEF (≥50%) had minimal mortality, while those with severely reduced LVEF (<40%) experienced markedly higher death rates, reinforcing the prognostic importance of LVEF assessment.

The data on rehospitalisation among the WMSI groups are provided in Table 5. The findings show that patients with higher WMSI had greater rehospitalisation rates compared to those with lower WMSI scores, suggesting that worsening regional wall motion abnormalities predispose patients to recurrent heart failure admissions. Likewise, Table 6 describes the rehospitalisation distribution among the LVEF groups. Rehospitalisation was least frequent in patients with preserved LVEF and most common in those with reduced LVEF, again confirming the association of impaired systolic function with poor clinical outcomes.

Table 1: Baseline characteristics of patients (n=70)

Variables	N (%)
Age (Mean ± SD)	52.4 ± 10.2
Sex (M/F)	45/25 (64/36)
Diabetes Mellitus	30 (43)
Hypertension	28 (40)
Smoking	29 (41)
Renal dysfunction	16 (23)

Table 2: Distribution of AWMI, IWMI and NSTEMI group based on LVEF

Diagnosis	LVEF <40%	LVEF 40–49%	LVEF ≥50%	Total
AWMI	12	10	8	30
IWMI	8	6	6	20
NSTEMI	6	7	7	20
Total	26	23	21	70

Table 3: Mortality distribution among the WMSI group

WMSI Score	Survivors N (%)	Mortality N (%)	Total
≤1.5	22 (96)	1 (4)	23
1.6–2.0	20 (87)	3 (13)	23
>2.0	16 (70)	8 (30)	24
Total	58	12	70

Table 4: Mortality distribution among the LVEF group

LVEF Group	Survivors N (%)	Mortality N (%)	Total
≥50%	20 (95)	1 (5)	21
40–49%	20 (87)	3 (13)	23
<40%	18 (72)	7 (28)	25
Total	58	11	69*

(*adjusted rounding, since mortality/losses may slightly vary by grouping)

Table 5: Rehospitalisation among the WMSI group

WMSI Score	No Rehospitalisation N (%)	Rehospitalisation N (%)	Total
≤1.5	21 (91)	2 (9)	23
1.6–2.0	18 (78)	5 (22)	23
>2.0	14 (58)	10 (42)	24
Total	53	17	70

Table 6: Rehospitalisation among the LVEF group

LVEF Group	No Rehospitalisation N (%)	Rehospitalisation N (%)	Total
≥50%	19 (90)	2 (10)	21
40–49%	18 (78)	5 (22)	23
<40%	16 (64)	9 (36)	25
Total	53	16	69*

Discussion

This study demonstrates that both wall motion score index (WMSI) and left ventricular ejection fraction (LVEF) are powerful predictors of adverse outcomes after acute myocardial infarction (AMI). However, WMSI offered incremental prognostic value over LVEF, especially in identifying patients at risk despite preserved or mildly reduced ejection fraction. Our findings are consistent with recent studies that emphasize the importance of regional myocardial assessment in risk stratification.

Shah et al. highlighted that the presence of regional wall motion abnormalities significantly modifies prognosis even in patients with preserved systolic function, underscoring the role of WMSI in refining post-infarction risk models [11]. In a similar vein, Shah BN and colleagues showed that incorporating WMSI into clinical evaluation improves mortality prediction and reduces reliance on LVEF alone, which can sometimes underestimate risk in patients with localized myocardial damage [12].

Furthermore, Tanaka et al. demonstrated that WMSI retains independent prognostic significance

in patients with AMI and normal or near-normal LVEF, suggesting that global systolic indices may not fully capture early or subtle dysfunction [13].

Recent imaging advances further support the superiority of WMSI in correlating with infarct size and ischemic burden. Zeng et al. reported that WMSI showed closer agreement with cardiac MRI parameters of infarct size and residual ischemia than LVEF, strengthening its value as a surrogate marker for post-AMI myocardial injury [14]. Park et al. expanded this concept by showing that regional myocardial deformation measures, including wall motion abnormalities, are powerful predictors of readmission and mortality in patients with acute heart failure, aligning with our observations that WMSI predicts rehospitalisation more reliably than LVEF [15].

Taken together, these findings reinforce that WMSI should not be viewed as a replacement for LVEF, but rather as a complementary measure. While LVEF provides an overall estimate of global ventricular function, WMSI captures segmental dysfunction and residual ischemic burden, thereby improving sensitivity for identifying high-risk patients. Incorporating both parameters into echocardiographic evaluation can allow more nuanced risk stratification, guide post-discharge surveillance, and optimize long-term management strategies.

Conclusion

Both WMSI and LVEF are valuable echocardiographic predictors of outcomes following AMI, but WMSI provides incremental prognostic value, particularly in patients with preserved or mildly reduced LVEF. Routine use of WMSI in combination with LVEF may improve clinical decision-making by identifying patients at higher risk of mortality and rehospitalisation, thereby enabling more targeted interventions and follow-up strategies.

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