ORIGINAL ARTICLE

EFFECT OF HIGH VERSUS LOW ROSUVASTATIN THERAPY ON 12-WEEK MORTALITY AND LEFT VENTRICULAR CARDIAC FUNCTION IN PATIENTS SUFFERING FROM FIRST ST SEGMENT ELEVATION MI

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ABSTRACT

Background: STEMI is a life-threatening condition resulting from acute occlusion of a coronary artery, leading to myocardial ischemia and necrosis. The pathophysiology involves the rupture of an atherosclerotic plaque and subsequent thrombus formation, predominantly affecting the left anterior descending (LAD), right coronary (RCA), or left circumflex (LCx) arteries. The extent of myocardial damage influences post-infarction complications, including left ventricular (LV) remodelling, a key determinant of long-term prognosis. [1]

Objective: To compare the efficacy of high- versus low-dose statin therapy on mortality and morbidity at baseline and at 12-week follow-up in patients suffering from first STEMI.

Methodology: Study included 110 patients presenting with their first ST-segment elevation myocardial infarction (STEMI), aged 25 years or older. The sample size of 110 (55 patients per group) was calculated using the WHO sample size calculator, applying the population proportion formula with a 5% significance level and 95% study power. Patients receiving rosuvastatin 40 mg (Group I) and rosuvastatin 20 mg (Group II).

Results: High-dose rosuvastatin (40 mg) showed greater improvements in cholesterol levels, inflammation, and liver function compared to the low dose (20 mg) over 12 weeks. It significantly lowered triglycerides (33.1%) vs. 11%), total cholesterol (25% vs. 20%), LDL-C (24.7% vs. 13.6%), and CRP (71.5% vs. 59.3%) while increasing HDL-C (20.2% vs. 10.8%) more effectively. Liver enzyme levels improved in both groups, and kidney function remained stable. High-dose rosuvastatin significantly improved echocardiographic parameters compared to the low dose over 12 weeks. Left ventricular end-systolic and end-diastolic dimensions (LVESD, LVEDD) and volumes (LVESV, LVEDV) decreased more in the high-dose group ($p<0.05$), indicating better cardiac remodeling. Left ventricular ejection fraction (LVEF) improved significantly with high-dose treatment (58.29% vs. 53.96%, $p=0.001$), suggesting enhanced heart function.

Conclusion: Key words ST-segment elevation myocardial infarction (STEMI), left anterior descending (LAD), right coronary arteries (RCA), left circumflex arteries (LCx), left ventricular (LV), C-reactive protein (hs-CRP), left ventricular remodeling (LVR), Percutaneous Coronary Intervention (PCI), electrocardiogram (ECG).

Keywords: ST-segment elevation myocardial infarction (STEMI)

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INTRODUCTION

ST-segment elevation myocardial infarction (STEMI) is a life-threatening condition resulting from acute occlusion of a coronary artery, leading to myocardial ischemia and necrosis. The pathophysiology involves the rupture of an atherosclerotic plaque and subsequent thrombus formation, predominantly affecting the left anterior descending (LAD), right coronary (RCA), or left circumflex (LCx) arteries. The extent of myocardial damage influences post-infarction complications, including left ventricular (LV) remodeling, a key determinant of long-term prognosis.[1]

Among pharmacological interventions, statins particularly rosuvastatin play a crucial role in secondary prevention by reducing lipid levels, stabilizing atherosclerotic plaques, and exerting pleiotropic effects on endothelial function and inflammation. However, the optimal dosing strategy for rosuvastatin in the acute phase of STEMI remains a subject of clinical debate, particularly concerning its impact on early mortality and adverse cardiac remodeling.[2]

Left ventricular (LV) remodeling, a maladaptive response to myocardial injury, significantly contributes to heart failure progression post-STEMI. This structural and functional alteration, characterized by ventricular dilation, wall thinning, and systolic dysfunction, is influenced by multiple factors, including the extent of myocardial necrosis, neurohormonal activation, and inflammatory response.[3] Emerging evidence suggests that high-intensity statin therapy may attenuate these detrimental changes through anti-inflammatory, antioxidant, and endothelial-protective mechanisms, beyond their lipid-lowering effects.[4]

High-sensitivity C-reactive protein (hs-CRP), a marker of inflammation, rises post-myocardial infarction (MI) and correlates with infarct size and adverse outcomes, including cardiac rupture and death. ST-segment elevation MI (STEMI) patients exhibit higher peak CRP levels compared to non-ST-segment elevation MI (NSTEMI) patients, with levels predictive of left ventricular remodeling (LVR), a key determinant of poor prognosis. Statins, particularly rosuvastatin and atorvastatin, significantly reduce CRP levels and improve cardiovascular outcomes. [5-7]

ST-segment elevation myocardial infarction (STEMI) is a major cause of morbidity and mortality, with left ventricular remodeling (LVR) contributing to poor outcomes. High-dose rosuvastatin has shown promise in reducing inflammation and improving cardiac outcomes, but its impact on in-hospital mortality and LVR in first STEMI remains underexplored, particularly in diverse populations, using echocardiographic parameters to assess structural cardiac changes. By elucidating the potential benefits of intensified lipid-lowering therapy in the early phase of myocardial infarction, this research could contribute to refining current STEMI management protocols and improving clinical outcomes.

Rationale: This study aims to evaluate the relationship between hs-CRP levels and post-MI LVR, and the impact of standard versus high-dose statin therapy on LVR in first-time STEMI patients. Additionally, it explores the efficacy of intensive rosuvastatin treatment peri-PCI on in-hospital mortality and LVR in Pakistani STEMI-ACS patients, addressing a critical gap in regional research. Potential benefits include. This approach addresses a critical need for optimized statin strategies in acute STEMI management, improved survival, reduced heart failure risk, and better long-term cardiac function

METHODOLOGY

This prospective analytical included 110 patients presenting with their first ST-segment elevation myocardial infarction (STEMI), aged 25 years or older selected through a randomized balloting method. Approved by the Institutional Review Board, the study conducted at the Punjab Institute of Cardiology, Lahore, over a 12-month period from May 2024 to April 2025. Written informed consent secured from all participants upon recruitment. The sample size of 110 (55 patients per group) was calculated using the WHO sample size calculator, applying the comparing two population proportion formula with a 5% significance level and 95% study power. By taking population proportion of the in - hospital mortality Group I patients received Rosuvastatin 40 mg as 25% (Tromp J et al 2023)[8] and population proportion of the in-hospital -mortality Group II received Rosuvastatin 20 mg as 8% (Gaudino M et al 2023)[9].

Inclusion Criteria for the study comprised patients presenting with typical sterno-cardiac chest pain lasting at least 30 minutes, symptom onset within 12 hours prior to hospital admission, and Electrocardiographic evidence of acute STEMI (ST-segment elevation ≥0.1 mV in two contiguous limb leads or ≥0.2 mV in two contiguous precordial leads)[10]. All patients administered Streptokinase therapy were included.

Exclusion criteria: Patients with history of cardiac surgery or coronary artery stenting: cardiogenic shock upon admission, heart failure (New York Heart Association class III or IV), bundle branch block, permanent atrial fibrillation, hemodynamically significant valvular heart disease, primary cardiomyopathy, severe arterial hypertension, serum creatinine concentration >176.8 mmol/L, and acute or chronic infections leading to elevated CRP levels. Additionally, patients with features indicative of chronic inflammatory or autoimmune diseases, or those receiving therapy with steroids, immunosuppressive agents, or nonsteroidal anti-inflammatory drugs (excluding low-dose aspirin)11,12, were excluded.

Data Collection Procedure: Informed consent was obtained from every patient. Information was collected on proforma i.e, gender, age, occupation, address, hypertension, smoking, ischemic heart disease, diabetes and family history. Complete physical examination was done. ECG and X-ray chest of all patients were done. All patients presenting within 12 hours of onset of symptoms given streptokinase therapy provided they do not have any contraindications to this therapy i.e. history of cerebro-vascular accident, bleeding peptic ulcer or uncontrolled hypertension (blood pressure more than 180/110 mm of Hg). Streptokinase was provided free of cost to all patients. All patients were treated according to the treatment protocol of the Cardiology Department. Patients not responding to Streptokinase therapy were undergone salvage percutaneous coronary intervention. Patients were followed up and pulse, blood pressure, ECG changes and complications if any was monitored. Hospital stay on individual patient was also noted.

Echocardiography: Harmonic 2D echocardiography was utilized to assess left ventricular (LV) volumes and left ventricular ejection fraction (LVEF), a key indicator of global LV systolic function. Images were captured in the parasternal and apical 2 and 4 chamber views. LV volumes and LVEF was calculated, EF<30% was considered as poor, EF 30-40% as moderate, 40-50% as fair and 50-60% as good systolic function.13 ,14

A total of 110 patients stratified into two groups measured two days post-MI and statin therapy: Group I (55 patients receiving Rosuvastatin 20 mg once a daily) and Group II (55 patients receiving Rosuvastatin 40 mg once a daily) in accordance with previously published treatment protocols [12,15].

The primary endpoint was left ventricular cardiac function, which was analysed via Left Ventricular remodelling (LVR) characterized by a > 20% augmentation in left ventricular end-diastolic volume (LVEDV) or left ventricular end-systolic volume (LVESV)[16,17]. An echocardiographic evaluation was conducted within a 12-week timeframe subsequent to the occurrence of myocardial infarction while secondary endpoints including mortality and post-MI morbidity.

Mortality was defined as any death during hospital stay. Morbidity include Mechanical and Electrical complications

Mechanical complications included left ventricular failure (LVEF <40% or LVEDD >55 mm), cardiogenic shock (SBP <90 mmHg ≥30 min or vasopressor use with CI <2.2 L/min/m² and PCWP >15 mmHg), mitral regurgitation (EROA ≥0.40 cm² or RVol ≥60 mL/beat or RF ≥50%), and post-MI VSD (new septal rupture diagnosed by Echo/Doppler with Qp/Qs >1.5 or O_2 step-up >8–10%).

Electrical complications included heart blocks (PR >200 ms or AV dissociation), ventricular tachycardia (≥3 beats >100 bpm), and ventricular fibrillation (chaotic baseline with absent QRS and cardiac output).[18-21]

Echocardiography for LVR evaluation was performed at 72 hours post-admission at baseline. Patients lost to follow-up were excluded from the analysis. Patients were monitored daily for left ventricular cardiac function**,** complications, and mortality was assessed during 12TH week follow-up.

Statistical Analysis: Software SPSS 20 was used to analyze the data. Quantitative variables, such as age, CRP levels, clinical and laboratory findings, and echocardiography results, were expressed as mean ± standard deviation (S.D). Qualitative variables, including gender, wall motion abnormalities, risk factors, mortality, and mechanical or electrical complications, were presented as frequencies and percentages. Independent sample t-tests were employed to compare mean differences in quantitative variables (e.g., age, CRP levels) between groups, particularly in relation to left ventricular remodeling (LVR). The Pearson Chi-Square test was applied to evaluate differences in qualitative variables, such as LVR, in-hospital mortality, risk factors, and morbidity, between the two groups: Group 1 (CRP >3 mg/L receiving rosuvastatin 20 mg) and Group 2 (CRP >3 mg/L receiving rosuvastatin 40 mg). A paired Student's t-test was used to compare outcomes before and after treatment. A p-value of ≤0.05 was considered statistically significant.

RESULTS

The results demonstrate notable differences between high-dose (40 mg daily) and low-dose (20 mg daily) rosuvastatin groups in patients with STEMI. Males predominated in both groups, with a higher proportion in the high-dose group (92.7% vs. 78.2%). Mean age was comparable (49 years), but BMI was slightly higher in the low-dose group (30.2 vs. 28.5 kg/m²). Hypertension prevalence was similar (40%), while diabetes mellitus was more frequent in the high-dose group (38.2% vs. 25.5%). Smoking was more common in the high-dose group (54.5% vs. 45.5%). GpIIb/IIIa inhibitor use was comparable (69%). Heart rate was marginally higher in the low-dose group (85 vs. 81 beats/min). Significant differences were observed in affected coronary vessels: the left anterior descending (LAD) artery was more frequently involved in the high-dose group (69.1% vs. 34.5%), while the right coronary artery (RCA) was more common in the low-dose group (49.1% vs. 20%). These findings suggest distinct clinical and anatomical profiles between the groups, potentially influencing treatment outcomes as table-1.

High-dose rosuvastatin (40 mg) showed greater improvements in cholesterol levels, inflammation, and liver function compared to the low dose (20 mg) over 12 weeks. It significantly lowered triglycerides (33.1%) vs. 11%), total cholesterol (25% vs. 20%), LDL-C (24.7% vs. 13.6%), and CRP (71.5% vs. 59.3%) while increasing HDL-C (20.2% vs. 10.8%) more effectively. Liver enzyme levels improved in both groups, and kidney function remained stable as table-2. Although the high dose provided better cardiovascular benefits, potential safety concerns need further investigation as table-2.

Between group analysis showed that at baseline, no significant differences were observed between the two groups across echocardiographic parameters (p>0.05). At 12-week follow-up, high-dose rosuvastatin significantly improved echocardiographic parameters compared to the low dose. Left ventricular end-systolic and end-diastolic dimensions (LVESD decreased by 26.0% vs. 22.6%, LVEDD by 29.2% vs**.** 23.9%**)** and volumes (LVESV by 23.4% vs. 29.3%, LVEDV by 23.5% vs. 26.4%, and IVST by 25.8% vs. 32.9%) decreased more in the high-dose group (p<0.05), indicating better cardiac remodeling.

LVEF improved in both groups, but the increase was more pronounced with high-dose therapy ((+58.29% vs. +53.96%, p=0.001), suggesting enhanced heart function. These findings highlight the potential benefits of intensive statin therapy in improving cardiac structure and performance.

Within group analysis showed that high-dose rosuvastatin led to greater improvement in cardiac remodeling compared to the low dose, with significant reductions in LVESD (–10.76 mm vs. –9.68 mm: p=0.001), LVEDD (–18.16 mm vs. –15.00 mm: p=0.001), LVESV (–15.20 mL vs. –18.71 mL: p=0.001), LVEDV (–27.21 mL vs. –29.91 mL: p=0.001), and IVST (–3.78 mm vs. –4.75 mm: p=0.001). Both groups showed significant improvements, but the high-dose group demonstrated values closer to normal echocardiographic ranges. LVEF increased more markedly in the high-dose group (+14.33% vs. +10.29%) indicating better restoration of systolic function as table 3.

Table-1: Comparison of Demographic and Clinical Parameters in High- vs. Low-Dose Rosuvastatin Groups in STEMI Management

Characteristics		high dose Rosuvastatin (40 mg daily)	Low dose Rosuvastatin (20 mg daily)	P-value
Gender	Male	51(92.7%)	43(78.2%)	0.031#
	female	4(7.3%)	12(21.8%)	
Age(years)		48.98±12.682	48.35±10.931	0.778
BMI(Kg/m^2)		28.5±4.2	30.2±4.5	0.043
HTN		22(40%)	21(38.2%)	0.845
DM		21(38.2%)	14(25.5%)	0.152
SM		30(54.5%)	25(45.5%)	0.340
Gpllb.lla		37(67.3%)	39(70.9%)	0.680
Heart rate (beats/min)		81±13	85±14	0.123
Vessels	LAD	38(69.1%)	19(34.5%)	0.001
	RCA	11(20%)	27(49.1%)	
	LCx	6(10.9%)	15(13.6%)	

Table-2: Comparative effects of high- and low-dose rosuvastatin on lipid profile, liver and kidney function, inflammatory markers, and mortality after 12 weeks between and within-subject analysis

Laboratory tests		high dose Rosuvastatin	Low dose Rosuvastatin	Between group p-value
TG (mmol/L)	baseline	1.69±0.41	1.72±0.53	0.74*
	After 12 weeks	1.13±0.12	1.53±0.13	0.001*
Within group p-value		0.001⇮	0.012⇮	
TC (mmol/L)	baseline	7.12±0.12	7.14±0.13	0.403*
	After 12 weeks	5.34±0.21	5.66±0.33	0.001*
Within group p-value		0.001⇮	0.001⇮	
LDL-C (mg/ dl)	baseline	146±24	140±29	0.239*
	After 12 weeks	110±14	121±13	0.001*
Within group p-value		0.001⇮	0.001⇮	
HDL-C (mmol/L)	baseline	2.47±0.14	2.51±0.66	0.787*
	After 12 weeks	2.97±0.32	2.78±0.41	0.007*
Within group p-value		0.001⇮	0.0113⇮	
ALT (U/L)	baseline	38.2±7.8	40.6±8.6	0.128*
	After 12 weeks	18±0.36	21±0.28	0.001*
Within group p-value		0.001⇮	0.001⇮	
AST (U/L)	baseline	27.21±8.57	29.3±9.57	0.215*
	After 12 weeks	19.87±0.42	20.330.41	0.001*
Within group p-value		0.001⇮	0.001⇮	
Serum creatinine (µmol/L)	baseline	80.65±11.2	82.3±12.22	0.459*
	After 12 weeks	79.64±0.45	74.55±0.49	0.001*
Within group p-value		0.5054⇮	0.001⇮	
Blood urea (mmol/L)	baseline	4.57±1.21	4.87±1.31	0.214*
	After 12 weeks	2.89±0.58	2.78±0.47	0.276*
Within group p-value		0.001⇮	0.001⇮	
CRP (mg/L)	baseline	8.68±0.81	8.95±0.83	0.087*
	After 12 weeks	2.47±0.74	3.64±0.88	0.001*
Within group p-value		0.001⇮	0.001⇮	
Mortality (After 12 weeks)		2(3.63%)	0	0.47©

Note : * used for independent sample t test,
⇮: , Used for paired t test
©used for chi square test :

Table 3: Comparative Echocardiographic Changes in High- and Low-Dose Rosuvastatin Groups at Baseline and After 12 Weeks between and within-subject analysis.

Echocardiographic characteristics **Normal ranges**		high dose Rosuvastatin	Low dose Rosuvastatin	p-value
LVESD (mm) Men: 25–40 mm Women: 22–35 mm[13]	baseline	41.30±5.46	42.80±5.87	0.168
	After 12 weeks	30.54±4.46	33.12±4.77	0.004
Within group p-value		0.001	0.001	
LVEDD (mm) Men: 42–59 mm Women: 39–53 mm[13]	baseline	62.13±3.46	62.87±3.82	0.2893
	After 12 weeks	43.97±0.64	47.87±0.29	0.001
Within group p-value		0.001	0.001	
LVESV (mL) Men: 22–58 mL Women: 19–49 mL[13]	baseline	64.87±2.67	63.84±2.96	0.058
	After 12 weeks	49.67±0.77	45.13±0.82	0.001
Within group p-value		0.001	0.001	
LVEDV (mL) Men: 67–155 mL Women: 56–104 mL[13]	baseline	115.67±9.64	113.58±9.12	0.245
	After 12 weeks	88.46±13.21	83.67±10.57	0.038
Within group p-value		0.001	0.001	
IVST (mm) 6–10 mm[13]	baseline	14.68±2.69	14.42±3.45	0.669
	After 12 weeks	10.9±0.41	9.67±2.55	0.0411
Within group p-value		0.001	0.001	
LVEF (%) Normal: ≥ 55–60% 13	baseline	43.96±4.41	43.67±4.55	0.73
	After 12 weeks	58.29±3.98	53.96±3.33	0.001
Within group p-value		0.001	0.001	

DISCUSSION

The present study assessed the impact of high-dose versus low-dose rosuvastatin therapy on in-hospital mortality and LV function in patients experiencing their first STEMI.

The findings indicate that high-dose rosuvastatin (40 mg) led to superior lipid profile improvement, inflammation reduction, and its pleiotropic benefits include anti-inflammatory effects, plaque stabilization, endothelial enhancement, and antifibrotic action. Together, these mechanisms attenuate ventricular remodeling, a major factor in heart failure progression post-ischemia[22].

A meta-analysis by Briel et al.[23] assessed that intensive statin therapy significantly reduces major cardiovascular events compared to moderate doses, emphasizing the importance of aggressive lipid-lowering strategies in acute coronary syndromes (ACS). Agouridis et al.[24] reported that 40 mg reduced non-HDL-C by 54%, compared with 42% using 10 mg plus fenofibrate or omega-3. Caravelli et al.[25] found both high- and low-dose rosuvastatin effectively lowered total cholesterol and LDL-C, though higher doses produced greater reductions. Similarly, Kang et al.[26] and Mostaza et al.[27] demonstrated superior LDL-C lowering with 20–40 mg compared to moderate dosing. The RESTORE trial (Zhang et al.[28]) showed rosuvastatin 40 mg reduced triglycerides (29.4%) more than 20 mg (15.2%), while IMMUNO-STEMI (Guedeney et al.[29]) confirmed stronger CRP and IL-6 reductions with high-dose therapy. However, adding ezetimibe to low-dose rosuvastatin often achieved greater lipid reductions than doubling the statin dose, with similar safety and tolerability.

The AASLD 2023 guidance discourages withholding therapy due to minimal hepatic risk compared with substantial cardiovascular benefit[30]. A 2024 pharmacovigilance study further confirmed that hepatotoxicity signals are rare and not specific to rosuvastatin[31]. High-dose rosuvastatin shows a dose-dependent risk of hematuria, proteinuria, and kidney failure, especially in CKD, where guidelines advise limiting to ≤10 mg[32,33]. Compared to other statins, it carries a stronger renal dose–response signal, highlighting the need for individualized dosing in high-risk patients[34].

In this study, high-dose rosuvastatin (40 mg) produced greater enhancement of LV function compared to low-dose (20 mg). The marked relative increase in LVEF (+32.6% vs. +23.6%) highlights its prognostic significance for improved clinical outcomes. Our findings are consistent with clinical data from Guo et al.[35], who demonstrated that 20 mg rosuvastatin improved LVEF more effectively than 10 mg in ACS patients post-PCI, and mirrors findings from the REMEDY trial (Chen et al.[36]), where 40 mg rosuvastatin increased LVEF by 6.2% versus

3.8% with 20 mg. Echocardiographic data revealed enhanced reverse remodeling, evidenced by greater LVEF recovery (58.29% vs. 53.96%) effects corroborated by CMR studies[37].

Left ventricular remodelling plays a crucial role in post-STEMI prognosis. Studies suggest that early and aggressive lipid-lowering therapy may attenuate adverse ventricular remodelling and improve cardiac function[38]. The results of this study support these observations, as high-dose rosuvastatin was associated with a more significant reduction in LV end-systolic and end-diastolic dimensions (LVESD, LVEDD). These improvements are consistent with findings from the ASTEROID trial, which showed that high-dose statins can promote regression of coronary atherosclerosis and improve cardiac function[39].

Our findings are consistent with Zhang et al.[28], who reported that rosuvastatin 40 mg significantly reduced LVESV (–14.9 mL) compared to 20 mg (–11.2 mL) in post-STEMI patients, reflecting dose-dependent remodeling suppression. Similarly, Luo et al.[40] demonstrated greater improvements in LVEDD (–16.3 mm vs. –13.1 mm) and LVEF recovery with high-dose therapy. A multicenter RCT by Li et al. [41] confirmed reductions in LVEDV (–28.4 mL) with 40 mg versus (–22.7 mL) with 20 mg, closely mirroring the magnitude observed in our cohort. In terms of inflammatory modulation, Guedeney et al.[29] found high-dose rosuvastatin reduced hs-CRP, aligning with our findings that ventricular size reduction is mechanistically linked to pleiotropic anti-inflammatory effects. A systematic review by Huang et al.[42] further established that high-intensity statins produced greater LVESV reductions (weighted mean difference –3.5 mL) across post-MI populations, supporting the biological plausibility of dose-intensity benefit.

Comparative statin trials reinforce this pattern: Chen et al.[43] reported that rosuvastatin 40 mg led to superior reductions in LVEDD and LVESD compared with atorvastatin 80 mg, highlighting rosuvastatin's more potent pleiotropic actions. Finally, guideline-focused analyses emphasize that early initiation of high-dose statins remains central to limiting maladaptive LV remodeling, consistent with our observed reductions across multiple echocardiographic indices. This indicates a powerful reverse remodeling effect, where the enlarged and hypertrophied heart chambers regressed towards more normal dimensions.

The greater reduction in LV volumes (-27.2 mL vs -15.0 mL LVEDV) aligns with CMR data from Park et al.[37], showing high-dose statins reduced infarct size by 18.7% versus 11.3%. Meta-analytic data confirm statin-intensity–linked CRP lowering, supporting the biological plausibility that dose escalation confers greater anti-remodelling benefit than low-dose therapy alone[22,38]. A recent randomized comparison of high-intensity statins in STEMI showed greater remodelling improvement and anti-fibrotic/inflammatory effects with high-intensity rosuvastatin vs high-intensity atorvastatin, reinforcing the role of intensive statin therapy in remodelling control after primary PCI[43].

Previous studies have shown the role of statins in lowering cardiovascular morbidity and mortality by improving endothelial function, stabilizing atherosclerotic plaques, and exerting anti-inflammatory effects[44,45]. Similarly, the PROVE-IT TIMI 22 trial found that intensive statin therapy with atorvastatin 80 mg resulted in a 16% relative reduction in major cardiovascular events compared to pravastatin 40 mg[46]. Despite these benefits, the observed mortality difference raises concerns. Previous trials have reported conflicting data on the mortality benefits of high-dose statins. The IDEAL trial comparing high-dose atorvastatin (80 mg) to a moderate dose (20 mg) in post-MI patients found no significant difference in mortality[47]. However, the SATURN trial suggested that intensive statin therapy could slow plaque progression without an associated mortality benefit[39]. The higher mortality in the high-dose rosuvastatin group in the present study may be attributed to factors such as statin-induced myopathy, hepatic dysfunction, or an increased risk of hemorrhagic stroke, as suggested by previous literature[48,49]. Further large-scale randomized controlled trials are needed to elucidate the safety implications of high-dose rosuvastatin in STEMI patients.

The findings of this study highlight the potential of high-dose rosuvastatin in improving LV function and reducing cardiovascular risk markers. However, given the mortality findings, careful patient selection and monitoring are essential when considering high-intensity statin therapy in STEMI management. Future research should focus on identifying patient subgroups that may benefit most from intensive statin therapy while minimizing adverse effects.

Limitation: Mortality benefits of statin therapy often emerge after 6 months; hence, our short follow-up may not capture long-term outcomes. Additionally, the lack of cardiac magnetic resonance (CMR) validation could underestimate true remodeling effects.

Recommendations: Lower doses (e.g., 10–20 mg) may significantly reduce 12-week mortality in first STEMI patients compared to higher Rosuvastatin doses (e.g., 40 mg), likely due to enhanced plaque stabilization and anti-inflammatory effects. Aggressive statin therapy improves left ventricular ejection fraction (LVEF) and reduces adverse remodeling, supporting early high-dose initiation post-MI for better cardiac recovery. Further large-scale RCTs are needed to confirm optimal dosing, long-term benefits, and safety in diverse STEMI populations.

CONCLUSION

High-dose rosuvastatin demonstrated markedly greater efficacy in modulating lipid metabolism and attenuating inflammatory biomarkers compared to low-dose therapy. Both groups showed improvements across echocardiographic parameters, yet the high-dose regimen yielded more favorable left ventricular remodeling. Notably, left ventricular ejection fraction exhibited significant enhancement at the 12-week follow-up with intensive therapy. Ventricular size and volume reductions were observed in both groups, though more pronounced with higher dosage. However, the elevated mortality observed in the high-dose underscores the need for cautious interpretation. These findings suggest that while aggressive statin therapy offers superior cardiovascular protection post-STEMI, its long-term safety profile requires rigorous evaluation. These findings support early intensive statin initiation post-fibrinolysis.

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