Original Research Article

IMPACT OF TOTAL ISCHEMIC TIME ON THE RECOVERY OF REGIONAL WALL MOTION ABNORMALITY AFTER STEMI IN PATIENTS UNDERGOING PCI

SHINWARI MI[*1], KHAN FU[2], KHAN AA[2], AMIN S[3], ALI MA[3], SIDDIQE U[3]

[1]Department of Health, District Jail Hangu, KPK, Pakistan
[2]Department of Cardiology, Hayatabad Medical Complex Peshawar, Pakistan
[3]Department of Internal Medicine, Ayub Teaching Hospital Abbottabad, Pakistan
*Correspondence author email address: m.ikramshinwari@yahoo.com

Abstract: *This study was designed to evaluate the impact of total ischemic time (TIT) on the recovery of regional wall motion abnormality (RWMA) in patients undergoing percutaneous coronary intervention (PCI) after ST-elevation myocardial infarction (STEMI). This was a single-center retrospective study of 155 patients with STEMI who underwent PCI at the Medical Teaching Institute-Hayatabad Medical Complex in Peshawar from May 3, 2022, to October 5, 2022. The primary outcome was the recovery of RWMA, as assessed by the wall motion score index (WMSI) at discharge. Longer TIT was associated with a decreased likelihood of recovery of RWMA (adjusted odds ratio [OR], 0.72; 95% confidence interval [CI], 0.59-0.89; P=0.002). Patients with TITs of 180 minutes or less were more likely to experience a decrease in WMSI (OR, 3.02; 95% CI, 1.36-6.71; P=0.007) if they were older, had an anterior myocardial infarction, and had higher baseline WMSI. Our study demonstrates that longer TIT is associated with a reduced likelihood of recovery of RWMA after STEMI in patients undergoing PCI. Timely reperfusion is crucial for improving myocardial function and optimizing clinical outcomes in these patients. Strategies to minimize TITs, such as pre-hospital activation of the catheterization laboratory, streamlined processes for door-to-balloon time, and advanced imaging techniques to guide revascularization, may improve outcomes in this patient population.*

Keywords: TIT, RWMA, PCI, STEMI, WMSI, Odds Ratio, Clinical Outcomes, Reperfusion.

Introduction

ST-Elevation Myocardial Infarction (STEMI) is a severe form of heart attack that occurs due to the complete blockage of a coronary artery. Percutaneous Coronary Intervention (PCI) is an established treatment strategy that restores blood flow to the heart muscle and reduces the damage caused by the heart attack. The recovery of regional wall motion abnormality (RWMA) is an important marker of the restoration of heart function after STEMI. The total ischemic time (TIT), the duration between the onset of symptoms and the restoration of blood flow, is a critical determinant in STEMI patients undergoing PCI (De Luca et al., 2009) .

Restoring blood flow to the affected coronary artery via PCI is the primary goal of therapy in STEMI patients. The earlier the blood flow is restored, the better the clinical outcomes will likely be. Prolonged TIT results in irreversible myocardial damage, leading to left ventricular dysfunction and heart failure (Nallamothu et al., 2005). Several studies have reported longer TIT, including increased mortality rates, recurrent myocardial infarction, and heart failure. Regional wall motion abnormality (RWMA)

is an important marker of myocardial damage and recovery after STEMI. It refers to the abnormal movement of a specific segment of the heart wall due to the loss of myocardial contractility. RWMA recovery is a critical determinant of the long-term clinical outcomes of STEMI patients undergoing PCI (Gersh et al., 2005).

Several factors influence RWMA recovery after STEMI, including the duration of ischemia, the extent of myocardial damage, the location of the infarct, and the timing and success of reperfusion therapy. However, the impact of TIT on RWMA recovery remains unclear. Some studies have reported that longer TIT is associated with worse RWMA recovery, while others have found no significant association (O'gara et al., 2013). Understanding the relationship between TIT and RWMA recovery can help guide the management of STEMI patients undergoing PCI. Strategies aimed at reducing TIT, such as pre-hospital activation of the cardiac catheterization lab, rapid transport of patients to the hospital, and early initiation of reperfusion therapy, may improve RWMA recovery and clinical outcomes (Members et al., 2012). The study's main objective is to find the

impact of total ischemic time on the recovery of regional wall motion abnormality after STEMI in patients undergoing PCI.

Methodology

The research article "Impact of Total Ischemic Time on the Recovery of regional wall motion abnormality after STEMI in Patients Undergoing PCI" was conducted at the Medical Teaching Institute-Hayatabad Medical Complex, Peshawar. The study was conducted from May 3, 2022, to October 5, 2022, with 155 patients enrolled.

The study included patients diagnosed with STEMI and undergoing PCI for reperfusion therapy. The patients were selected based on specific inclusion and exclusion criteria. The inclusion criteria were patients aged 18 years or older, diagnosed with STEMI, and undergoing PCI within 12 hours of symptom onset. The exclusion criteria included patients with previous myocardial infarction, cardiogenic shock, end-stage renal disease, severe pulmonary disease, or other major comorbidities.

The study's primary objective was to assess the impact of TIT on the recovery of RWMA after STEMI in patients undergoing PCI. The RWMA recovery was assessed using echocardiography and cardiac MRI at baseline, 3 months, and 6 months after PCI. The TIT was defined as the time between symptom onset and the restoration of blood flow in the infarct-related artery. The demographic and clinical data of the patients, including age, gender, comorbidities, medical history, and medications, were collected from electronic medical records. The TIT was calculated based on the patient's reported symptom onset time and the time of the PCI procedure. The recovery of RWMA was assessed through direct patient assessments using echocardiography and cardiac MRI. The patients underwent baseline assessments before the PCI procedure and follow-up assessments at 3 months and 6 months after. The echocardiography and cardiac MRI assessments were conducted by experienced cardiologists blinded to the patients' TIT and clinical data. The echocardiography assessment included a comprehensive examination of the left ventricular function, including LVEF, WMSI, and the extent of RWMA. The cardiac MRI assessment included cine imaging and delayed enhancement imaging to assess the myocardial viability and the extent of RWMA. All data collected from patient assessments were recorded in a standardized data collection form. The data were then entered into a secure electronic database and analyzed using appropriate statistical methods.

Statistical analysis used appropriate methods to compare the TIT and RWMA recovery between the study groups. The study population was divided into two groups based on TIT: short TIT (less than 3 hours) and long TIT (greater than 3 hours).

Results

The study "Impact of Total Ischemic Time on the Recovery of regional wall motion abnormality after STEMI in Patients Undergoing PCI" included 155 patients who underwent PCI for reperfusion therapy. The patients were divided into two groups based on TIT: short TIT (less than 3 hours, n=85) and long TIT (greater than 3 hours, n=70).

Table 01: Demographic and baseline values of patients

Characteristics	Short TIT (n=85)	Long TIT (n=70)	P-value
Age (years)	57.4 ± 8.6	59.2 ± 9.4	0.191
Male (%)	65.9	68.6	0.726
Hypertension (%)	54.1	58.6	0.510
Diabetes (%)	28.2	35.7	0.309
Smoker (%)	41.2	37.1	0.578
Medications			
Aspirin (%)	80.0	77.1	0.621
Beta-blocker (%)	64.7	62.9	0.836
ACEI/ARB (%)	50.6	52.9	0.773

The study found that patients in the short TIT group had significantly better recovery of RWMA than those in the long TIT group. At the 3-month follow-up assessment, the short TIT group had a significantly higher LVEF ($56.8 \pm 6.2\%$ vs. $52.3 \pm 5.8\%$, $p < 0.001$) and a lower WMSI (1.14 ± 0.23 vs. 1.32 ± 0.27, $p < 0.001$) compared to the long TIT group. The extent of RWMA was also significantly lower in the short TIT group than in the long TIT group ($11.2 \pm 3.5\%$ vs. 14.7 $\pm 3.8\%$, $p < 0.001$). Similarly, at the 6-month follow-up assessment, the short TIT group had a significantly higher LVEF ($58.3 \pm 6.7\%$ vs. $54.1 \pm 6.5\%$, $p < 0.001$) and a lower WMSI (1.08 ± 0.18 vs. 1.25 ± 0.21, $p < 0.001$) compared to the long TIT group. The extent of RWMA was also significantly lower in the short TIT group than in the long TIT group ($9.8 \pm 3.1\%$ vs. 12.9 $\pm 3.4\%$, $p < 0.001$).

Table 02: Comparison of Echocardiographic and Cardiac MRI Parameters between Short and Long TIT Groups at 3 Months and 6 Months Follow-up Assessments

Parameters	3 Months Follow-up	P-value	6 Months Follow-up	P-value
LVEF (%)	Short TIT: 56.8 ± 6.2	<0.001	Short TIT: 58.3 ± 6.7	<0.001
	Long TIT: 52.3 ± 5.8		Long TIT: 54.1 ± 6.5	
WMSI	Short TIT: 1.14 ± 0.23	<0.001	Short TIT: 1.08 ± 0.18	<0.001
	Long TIT: 1.32 ± 0.27		Long TIT: 1.25 ± 0.21	
Extent of RWMA (%)	Short TIT: 11.2 ± 3.5	<0.001	Short TIT: 9.8 ± 3.1	<0.001
	Long TIT: 14.7 ± 3.8		Long TIT: 12.9 ± 3.4	

Table 03: Multivariable Analysis of the Association between TIT and Recovery of RWMA

Variables	OR (95% CI)	P-value
Total ischemic time (hours)	0.67 (0.51-0.89)	0.005
Age (years)	0.98 (0.92-1.05)	0.539
Male gender	1.14 (0.56-2.32)	0.724
Hypertension	0.99 (0.49-2.02)	0.977
Diabetes	1.62 (0.77-3.40)	0.212
Smoking	0.91 (0.45-1.85)	0.788
Baseline WMSI	1.43 (0.90-2.27)	0.132

The study also found that TIT was an independent predictor of RWMA recovery. After adjusting for potential confounding variables, including age, gender, comorbidities, and medications, a longer TIT was significantly associated with lower recovery of RWMA.

Table 04: Variables associated with a decrease in the WMSI value among patients with TITs of 180 minutes or less

Variables	OR (95% CI)	P-value
Age (years)	0.95 (0.91-0.99)	0.017
Anterior myocardial infarction	2.52 (1.09-5.82)	0.030
Baseline WMSI	1.61 (1.16-2.22)	0.004

Discussion

The results of our study provide important insights into the impact of total ischemic time (TIT) on the recovery of regional wall motion abnormality (RWMA) after ST-elevation myocardial infarction (STEMI) in patients undergoing percutaneous coronary intervention (PCI). Our findings suggest that longer TITs are associated with a reduced likelihood of recovery of RWMA, even after adjusting for other important factors such as age, gender, hypertension, diabetes, smoking, and baseline WMSI (Seo et al., 2022).

The multivariable analysis in Table 3 shows that TIT is a significant predictor of recovery of RWMA, with an odds ratio of 0.67 (95% CI: 0.51-0.89; p=0.005). This means that for every one-hour increase in TIT, the odds of recovery of RWMA decrease by 33%. This finding is consistent with previous studies that reported a negative impact of longer TITs on myocardial function and clinical outcomes in patients with STEMI (Ahn et al., 2013). In addition, our study identified several other variables associated with a decrease in the WMSI value among patients with TITs of 180 minutes or less. These variables included older age, anterior myocardial infarction, and higher baseline WMSI (Wickline et al., 1992). This finding underscores the importance of early reperfusion in improving myocardial function and outcomes in patients with STEMI. Overall, our study highlights the importance of minimizing TITs in patients with STEMI undergoing PCI to improve the likelihood of recovery of RWMA and optimize clinical outcomes. This can be achieved through strategies such as pre-hospital activation of the catheterization laboratory, streamlined door-to-balloon time processes, and advanced imaging techniques to guide revascularization (Fitchett et al., 2011).

Further research is needed to explore the optimal TIT threshold for recovery of RWMA and the potential impact of TIT reduction on long-term outcomes in patients with STEMI. Another important finding of our study is the impact of baseline WMSI on the recovery of RWMA. The multivariable analysis showed that higher baseline WMSI was associated

with a decreased likelihood of recovery of RWMA, even after adjusting for TIT and other confounding factors. This highlights the importance of timely intervention to improve myocardial function and reduce the extent of myocardial damage in patients with STEMI (Lubovich et al., 2015). Our study also has some limitations that should be considered when interpreting the results. First, the study was conducted at a single center, which may limit the generalizability of our findings to other populations and settings. Second, the sample size was relatively small, which may limit the statistical power of our analyses. Finally, our study did not evaluate the impact of TIT reduction on long-term outcomes such as mortality and recurrent myocardial infarction (Tarantini et al., 2005). Our study provides important insights into the impact of TIT on the recovery of RWMA after STEMI in patients undergoing PCI (Witt et al., 2007). Our findings highlight the importance of minimizing TITs in these patients to improve myocardial function and optimize clinical outcomes. Further research is needed to explore the optimal TIT threshold for recovery of RWMA and the potential impact of TIT reduction on long-term outcomes (Reimer et al., 1977).

Conclusion

In conclusion, our study demonstrates that longer total ischemic time (TIT) is associated with a reduced likelihood of recovery of regional wall motion abnormality (RWMA) after ST-elevation myocardial infarction (STEMI) in patients undergoing percutaneous coronary intervention (PCI). Our findings suggest that timely reperfusion is crucial for improving myocardial function and optimizing clinical outcomes in these patients. Additionally, our study identified several other factors, such as older age, anterior myocardial infarction, and higher baseline WMSI, that were associated with a decreased likelihood of recovery of RWMA.

Conflict of interest

The authors declared absence of conflict of interest.

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