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# COMPARATIVE STUDY OF RV SYSTOLIC DYSFUNCTION ASSESSED BY DOPPLER IMAGING AND SPECKLE TRACKING ECHOCARDIOGRAPHY AMONG PATIENTS WITH ANTERIOR AND ISOLATED INFERIOR WALL MI WITHIN 24 HRS OF PRIMARY PCI

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## Abstract

**Background:** Acute myocardial infarction (AMI) is a major global health burden, with right ventricular (RV) dysfunction significantly contributing to adverse outcomes. The functional interdependence between the left ventricle (LV) and RV suggests that different LV infarct locations may have varying impacts on RV performance. **Objectives:** To assess RV dysfunction in patients with anterior and inferior wall myocardial infarction within 24 hours of primary percutaneous coronary intervention (PCI) using tissue Doppler imaging and speckle tracking echocardiography (STE). Conventional RV function parameters such as tricuspid annular plane systolic excursion (TAPSE), myocardial performance index (MPI), and tricuspid annulus peak systolic velocity (S') were evaluated, along with RV strain derived from STE. **Materials and Methods:** A prospective observational study was conducted from May 2024 to October 2024, enrolling 66 patients (33 with anterior MI and 33 with inferior MI) at a tertiary care center in Jaipur, Rajasthan. Patients underwent successful PCI within 12 hours of ischemic chest pain onset. Echocardiographic assessments included RV function parameters (TAPSE, MPI, S') and RV strain analysis using STE. Statistical analyses were performed using SPSS version 21, with $p<0.05$ considered statistically significant. **Results:** Patients with anterior MI showed significantly worse RV function, as evidenced by lower TAPSE, S', and global longitudinal strain (GLS) compared to those with inferior MI ($p < 0.05$). Anterior MI was associated with lower LV ejection fraction (LVEF) and elevated RV MPI. The vascular territory of anterior MI primarily involved the left anterior descending artery (LAD), while inferior MI predominantly involved the right coronary artery (RCA). **Conclusion:** We concluded the profound impact of anterior MI on RV dysfunction compared to inferior MI. Advanced imaging modalities such as STE, play a crucial role in early detection of RV dysfunction, aiding in risk stratification and timely intervention to improve clinical outcomes.

## INTRODUCTION

Acute myocardial infarction (AMI) remains a significant global health challenge, associated with substantial morbidity and mortality.[1] Right ventricular (RV) dysfunction following AMI has been increasingly recognized as a critical factor contributing to adverse outcomes, including increased mortality and major adverse cardiovascular events (MACE).[2]

Right ventricular dysfunction following acute myocardial infarction is strongly linked to adverse clinical outcomes. RV involvement plays a crucial role in the development of cardiogenic shock in patients with AMI, highlighting its significance in influencing overall prognosis.[3] A study reported that RV involvement was identified in 54% of patients with AMI, demonstrating its substantial prognostic implications for adverse events.[4]

The RV's unique morphology and physiology render it more resistant to ischemia compared to the left ventricle (LV). However, the RV's function is closely linked to the LV via shared myocardial fibers and the interventricular septum, forming the anatomical and functional basis of ventricular interdependence.[5] Cabin et al. observed RV myocardial infarction in conjunction with anterior LV infarction in autopsy studies, emphasizing the interplay between the ventricles.[6] Unlike the LV, the RV exhibits minimal twisting and rotational movements, and its contraction is predominantly longitudinal. Studies by Venkatachalam et al. (2017) further elucidated the importance of assessing RV function in clinical settings, especially under changing hemodynamic conditions.[7]

Echocardiographic imaging of the RV is challenging due to its complex geometry. Conventional parameters such as RVFAC, TAPSE, tricuspid S' velocity, and RV myocardial performance index (RV MPI) primarily assess longitudinal function and are highly angle- and load-dependent. These limitations hinder their reproducibility and usefulness for serial measurements, making it difficult to compare results over time. While cardiac MRI is considered the gold standard for RV volumetric and functional assessment, its high cost and lengthy examination time limit its routine clinical use.[8,9] Elnoamany et al. (2014) highlighted the limitations of conventional echocardiographic indices in patients with pulmonary hypertension, further emphasizing the need for advanced imaging modalities.[10]

Speckle tracking echocardiography (STE) offers a novel, non-invasive approach to assess RV function by evaluating myocardial strain. Unlike conventional echocardiographic parameters, strain measurements reflect the intrinsic myocardial function, distinguishing active contraction from passive motion. RV longitudinal strain, validated in both animal and human studies, has demonstrated a stronger correlation with RV systolic function and greater prognostic value compared to TAPSE and tricuspid S' velocity.[11,12]

**Rationale for the Study**

Despite advancements in imaging techniques, the impact of different LV infarct locations on RV function in the absence of RV infarction remains underexplored. The RV's structural and functional interdependence with the LV suggests that anterior and inferior infarcts may have distinct effects on RV performance. Furthermore, early detection of subclinical RV dysfunction is crucial for risk stratification and timely intervention. This study aims to address these gaps by utilizing STE to detect subclinical RV dysfunction and correlate these findings with conventional echocardiographic parameters in patients with anterior versus isolated inferior AMI.

**Objectives:** To evaluate right ventricular (RV) dysfunction in patients with anterior or inferior wall myocardial infarction (MI) within 24 hours of undergoing primary percutaneous coronary intervention (PCI), using tissue Doppler imaging and strain analysis through speckle tracking echocardiography. Conventional RV function parameters, including tricuspid annular plane systolic excursion (TAPSE), myocardial performance index (MPI), and tricuspid annulus peak systolic velocity (S'), were assessed, along with the relationship between left ventricular (LV) ejection fraction and the type of MI with these parameters. Additionally, the study seeks to establish the correlation between conventional RV dysfunction parameters and RV strain derived from speckle tracking imaging in patients with anterior and inferior MI, providing a comprehensive analysis of RV functional impairments and the utility of advanced imaging techniques in detecting dysfunction.

## MATERIALS AND METHODS

This prospective observational study was conducted between May 2024 and October 2024 at a tertiary care center, Jaipur, Rajasthan. A total of 66 patients (33 with anterior MI and 33 with inferior MI) undergoing primary PCI were enrolled.

A sample of 30 cases were adequate at 95% confidence and 80% power to verify the expected difference of 10.10±8.15 in LVEF between cases of anterior and inferior MI (Hanan Ibrahim Radwan et al13). Considering 10% loss to follow-up sample size was further enhanced to 33 in each group.

The study population consisted of adult patients aged over 18 years who presented with acute myocardial infarction (AMI) and underwent primary percutaneous coronary intervention (PCI) for anterior or inferior ST-segment elevation myocardial infarction (STEMI) within 12 hours of the onset of ischemic chest pain. Inclusion required a door-to-balloon time of less than 90 minutes. Only patients with successful revascularization of the infarct-related artery, no post-procedure complications, and achievement of TIMI III flow were included in the study.

Patients with ST-segment elevation in V3R, V4R, or right precordial leads indicative of right ventricular infarction were excluded from the study. Patients with bundle branch block, interventricular conduction delays, a history of myocardial infarction, prior revascularization, abnormal left ventricular function, rheumatic heart disease, cardiomyopathy, cardiogenic shock, hemodynamic instability, heart failure, pulmonary hypertension, pulmonary embolism, chronic liver disease, or chronic renal failure were also excluded from the study.

Informed written consent was obtained from all patients after the study procedure was thoroughly explained to them using the Patient Information Sheet, ensuring their complete understanding and satisfaction.

**Data collection and procedure**

Upon enrollment, each patient underwent a comprehensive clinical examination to assess for any clinical signs of right ventricular (RV) failure, such as elevated jugular venous pressure (JVP), ascites, or edema. Routine laboratory investigations included a complete blood count (CBC), kidney and liver function tests (KFT/LFT), and cardiac biomarkers, including troponin and NT-proBNP levels.


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Additionally, chest X-rays were performed for all patients.

A 12-lead electrocardiogram (ECG) was conducted for every patient, including right precordial leads, to rule out RV infarction. All patients underwent primary percutaneous coronary intervention (PCI) of the culprit artery with successful establishment of TIMI III flow, ensuring a door-to-balloon time of less than 90 minutes. FDA-approved drug-eluting stents were utilized for revascularization.

Two-dimensional transthoracic echocardiography (2D-TTE) was performed using the Vivid™ S60N echocardiography machine (GE Healthcare) equipped with a GE 3Sc-RS probe (1.5–4 MHz). RV functional parameters and RV strain were derived from the modified apical 4-chamber (A4C) RV-focused view. For 2D longitudinal strain analysis, frame rates of 40–80 frames per second were utilized. The region of interest (ROI) width was maintained at 5 mm, as per the guidelines established by the American Society of Echocardiography (ASE). The myocardium of the interventricular septum (IVS) and the RV free wall were divided into three segments each (apical, mid, and basal), resulting in six segments. Longitudinal peak negative systolic strain was measured for each segment, and global RV systolic strain was also calculated.

The RV myocardial performance index (MPI) was measured using pulse Doppler by dividing the isovolumic time (IVCT + IVRT) by ejection time (ET). Ejection time was derived from pulse wave (PW) Doppler imaging at the RV outflow tract (RVOT), while the tricuspid valve opening-to-closure time (TCO) was obtained from pulsed Doppler imaging at the tricuspid valve.

Echocardiography was performed within 24 hours of primary PCI, and conventional measures of RV dysfunction, including tricuspid annular plane systolic excursion (TAPSE), tricuspid annulus peak systolic velocity (S'), MPI using PW Doppler and tissue Doppler imaging, were analyzed. Additionally, speckle-tracking imaging was utilized to calculate regional and global RV peak longitudinal strain. All measurements adhered to the ASE guidelines for the assessment of right heart function.

**Statistical Analysis:** The continuous data was presented in the form of mean and standard deviation. The Kolmogorov-Smirnov test was utilized to assess the normality of data distribution. Quantitative variables between study groups were compared using the Student's t-test for parametric data and the Mann-Whitney U test for non-parametric data. Discrete data were presented in the form of proportions and analysed using the Chi-square ($\chi^2$) test. A p-value of less than 0.05 was considered statistically significant. All statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS) software, version 21 for Microsoft Windows.

## RESULTS

[Table 1] This table compares baseline clinical characteristics such as age, sex, comorbidities (diabetes, hypertension), smoking status, and dyslipidemia between patients with anterior myocardial infarction (MI) and inferior MI. There were no statistically significant differences in these variables between the two groups ($p>0.05$), suggesting comparable baseline characteristics in terms of risk factors and demographic profiles.

[Table 2] This table highlights the differences in echocardiographic parameters between the anterior and inferior MI groups. Patients with anterior MI showed significantly lower left ventricular ejection fraction (LVEF), tricuspid annular plane systolic excursion (TAPSE), tricuspid annulus peak systolic velocity (S'), and higher right ventricular myocardial performance index (RV MPI) by both pulse Doppler and tissue Doppler methods. Additionally, troponin levels were significantly elevated in the anterior MI group. These findings suggest that anterior MI has a more profound impact on both left and right ventricular function compared to inferior MI ($p< 0.05$).

[Table 3] The left anterior descending artery (LAD) was predominantly involved in anterior MI (97%), whereas the right coronary artery (RCA) was primarily affected in inferior MI (72.7%). Patients with anterior MI also had significantly more LAD lesions with stenosis >70% (97% vs. 21.2%), while inferior MI had higher involvement of RCA lesions (78.8%). This table underscores the distinct vascular territories implicated in anterior versus inferior MI.

[Table 4] Patients with inferior MI demonstrated better RV function, with significantly lower strain values (indicating better contractility) across various segments, including the basal, mid, and apical free wall, and global longitudinal strain (GLS). The anterior MI group showed more impaired RV function, particularly in the apical free wall and overall free wall GLS, with significant differences ($p< 0.05$).

The mean LVEF was slightly higher in females (41.81 ± 4.64) compared to males (40.00 ± 5.39). TAPSE values were comparable between males (17.45 ± 1.45) and females (17.54 ± 1.64), while the mean Tricuspid Annulus S' values were similar for males (10.35 ± 1.27) and females (10.45 ± 1.23). The mean RV MPI by pulsed Doppler was 0.42 ± 0.07 in males and 0.41 ± 0.06 in females, whereas RV MPI by tissue Doppler showed comparable values of 0.51 ± 0.07 in males and 0.50 ± 0.07 in females. The basal septum strain was marginally more negative in females (-13.04 ± 2.20) compared to males (-12.86 ± 1.88), while the mid-septum strain was slightly more negative in males (-16.38 ± 1.27) compared to females (-16.17 ± 1.79). The apical septum strain values were nearly identical in males (-12.98 ± 2.07) and females (-12.92 ± 2.00). In terms of the basal free wall strain, females demonstrated slightly more


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negative values (-22.58 ± 3.79) compared to males (-21.64 ± 3.51), and the mid-free wall strain was also more negative in females (-23.54 ± 4.47) than in males (-22.64 ± 3.84). The apical free wall strain values were comparable between males (-15.60 ± 3.41) and females (-15.87 ± 2.98). Similarly, free wall global longitudinal strain (GLS) was slightly more negative in females (-21.63 ± 3.26) compared to males (-20.76 ± 3.08), and the overall GLS followed the same trend, being more negative in females (-18.89 ± 2.94) than in males (-18.36 ± 2.67). All these observed differences between males and females were found to be statistically not significant (p>0.05).

[Table 5] This table examines the correlations between various quantitative parameters of RV function (e.g., basal and apical septal strain, free wall GLS, and GLS) with age, LVEF, TAPSE, tricuspid annulus S', and RV MPI. LVEF, TAPSE, and tricuspid annulus S' showed significant negative correlations with RV strain parameters, indicating that reduced ventricular function is associated with impaired strain values. Conversely, RV MPI by pulse Doppler and tissue Doppler positively correlated with strain values, reflecting greater dysfunction.

[Table 6] This table compares RV function parameters in anterior MI patients with single-vessel versus multi-vessel disease. Patients with multi-vessel disease showed significantly worse LVEF, TAPSE, tricuspid annulus S', and GLS values, along with higher RV MPI values, indicating more severe RV dysfunction (p< 0.05). Free wall strain parameters (basal and apical) were also more impaired in the multi-vessel disease group.

[Table 7] This table evaluates RV function parameters in inferior MI patients based on single-vessel versus multi-vessel disease. Unlike anterior MI, there were no significant differences in most RV function parameters between the groups, except for minor variations in basal septum strain. This suggests that multi-vessel involvement in inferior MI has a less pronounced impact on RV function compared to anterior MI.

**Table 1: Clinical characteristics of cases with anterior and posterior MI group.**

| Variable | | Anterior MI | Inferior MI | p value |
|---|---|---|---|---|
| Age (Years) | | 59.00±8.48 | 55.42±10.29 | 0.128* |
| Sex | Female | 9(27.3) | 15(45.5) | 0.125** |
| | Male | 24(72.7) | 18(54.5) | |
| DM | Yes | 11(33.3) | 14(42.4) | 0.447** |
| | No | 22(66.7) | 19(57.6) | |
| HTN | Yes | 14(42.4) | 15(45.5) | 0.804** |
| | No | 19(57.6) | 18(54.5) | |
| Smoking | Yes | 20(60.6) | 17(51.5) | 0.457** |
| | No | 13(39.4) | 16(48.5) | |
| Dyslipidemia | Yes | 12(36.4) | 15(45.5) | 0.453** |
| | No | 21(63.6) | 18(54.5) | |

**Table 2: Echocardiographic findings of cases with anterior and posterior MI group**

| Variable | Anterior | Inferior | p value* |
|---|---|---|---|
| LVEF | 36.17±2.46 | 45.15±2.56 | <0.001 |
| TAPSE | 16.70±0.92 | 18.27±1.59 | <0.001 |
| TRICUSPID ANNULUS S' | 9.68±0.67 | 11.09±1.31 | <0.001 |
| RV MPI by pulse | 0.45±0.05 | 0.37±0.05 | <0.001 |
| RV MPI by Tissue doppler | 0.55±0.48 | 0.46±0.06 | <0.001 |
| Troponin level | 5.19±1.53 | 2.20±0.75 | <0.001 |

**Table 3: Affected vessels in cases with anterior and posterior MI group**

| Variable | | Anterior | Inferior | p value** |
|---|---|---|---|---|
| Culprit vessel | LAD | 32(97) | 1(3) | <0.001 |
| | LCX | 1(3) | 8(24.2) | |
| | RCA | - | 24(72.7) | |
| Vessels with more than 70% lesions | LAD | 32(97.0) | 7(21.2) | <0.001 |
| | LCX | 6(18.2) | 15(45.5) | 0.017 |
| | RCA | 6(18.2) | 26(78.8) | <0.001 |
| Number of vessels | 1 | 23(69.7) | 20(60.6) | 0.499 |
| | 2 | 10(30.3) | 12(36.4) | |
| | 3 | - | 1(3) | |
| Left main disease | Yes | 2(6.1) | 0 | 0.151 |
| | No | 31(93.9) | 33(100) | |

**Table 4: Right Ventricular longitudinal strain among cases with anterior and posterior MI group**

| Right Ventricular longitudinal strain | Anterior | Inferior | p value* |
|---|---|---|---|
| Basal Septum | -12.70±1.72 | -13.15±2.22 | 0.357 |
| Mid Septum | -16.09±1.07 | -16.52±1.77 | 0.243 |
| Apical Septum | -12.09±1.53 | -13.82±2.11 | <0.001 |
| Basal free wall | -19.48±2.17 | -24.48±2.99 | <0.001 |
| Mid free wall | -20.70±3.14 | -25.24±3.62 | <0.001 |


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| | | | |
|---|---|---|---|
| Apical free wall | -13.45±1.84 | -17.94±2.75 | <0.001 |
| Free wall GLS | -19.49±2.97 | -22.66±2.49 | <0.001 |
| GLS | -17.19±2.61 | -19.92±2.19 | <0.001 |

**Table 5: Correlation between quantitative variables of anterior and inferior wall MI cases**

| Variable | | Basal Septum | Mid Septum | Apical Septum | Basal free wall | Mid free wall | Apical free wall | Free wall GLS | GLS |
|---|---|---|---|---|---|---|---|---|---|
| Age | PCC | -0.119 | 0.064 | 0.015 | 0.161 | 0.04 | 0.03 | 0.071 | 0.072 |
| | p value | 0.339 | 0.609 | 0.907 | 0.197 | 0.753 | 0.812 | 0.57 | 0.565 |
| LVEF | PCC | -0.273 | -0.283 | -0.648 | -0.838 | -0.752 | -0.824 | -0.732 | -0.733 |
| | p value | 0.027 | 0.021 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| TAPSE | PCC | -0.397 | -0.363 | -0.706 | -0.756 | -0.773 | -0.753 | -0.743 | -0.738 |
| | p value | 0.001 | 0.003 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| TRICUSPID ANNULUS S’ | PCC | -0.296 | -0.435 | -0.645 | -0.807 | -0.806 | -0.836 | -0.771 | -0.784 |
| | p value | 0.016 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| RV MPI by pulse | PCC | 0.238 | 0.225 | 0.628 | 0.8 | 0.776 | 0.819 | 0.843 | 0.843 |
| | p value | 0.054 | 0.07 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| RV MPI by Tissue doppler | PCC | 0.25 | 0.243 | 0.644 | 0.813 | 0.794 | 0.828 | 0.831 | 0.835 |
| | p value | 0.043 | 0.049 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |

PCC: Pearson's correlation coefficient

**Table 6: Difference between patients with one vessel versus multivessels involved in anterior wall MI cases**

| Variable | One vessel | Multivessel | p value* |
|---|---|---|---|
| LVEF | 36.80±2.30 | 34.71±2.29 | 0.022 |
| TAPSE | 16.96±0.77 | 16.10±0.99 | 0.011 |
| TRICUSPID ANNULUS S’ | 9.87±0.6 | 9.25±0.64 | 0.011 |
| RV MPI by pulse | 0.44±0.05 | 0.48±0.05 | 0.045 |
| RV MPI by Tissue doppler | 0.54±0.04 | 0.58±0.05 | 0.072 |
| Basal Septum | -12.83±1.53 | -12.4±2.17 | 0.522 |
| Mid Septum | -16.09±1.24 | -16.1±0.57 | 0.975 |
| Apical Septum | -12.17±1.59 | -11.9±1.45 | 0.643 |
| Basal free wall | -20.17±1.83 | -17.9±2.13 | 0.004 |
| Mid free wall | -21.39±3.16 | -19.1±2.56 | 0.052 |
| Apical free wall | -14.00±1.54 | -12.2±1.93 | 0.008 |
| Free wall GLS | -20.37±2.63 | -17.46±2.8 | 0.007 |
| GLS | -17.94±2.36 | -15.45±2.43 | 0.010 |

**Table 7: Difference between patients with one vessel versus multivessels involved in inferior wall MI cases**

| Variable | One vessel | Multivessel | p value* |
|---|---|---|---|
| LVEF | 45.24±2.27 | 45.00±3.06 | 0.797 |
| TAPSE | 18.1±1.62 | 18.54±1.56 | 0.447 |
| TRICUSPID ANNULUS S’ | 11.09±1.32 | 11.11±1.34 | 0.962 |
| RV MPI by pulse | 0.36±0.05 | 0.38±0.06 | 0.377 |
| RV MPI by Tissue doppler | 0.46±0.05 | 0.47±0.07 | 0.411 |
| Basal Septum | -12.75±2.59 | -13.77±1.36 | 0.203 |
| Mid Septum | -16.85±1.95 | -16±1.35 | 0.182 |
| Apical Septum | -13.7±2.27 | -14±1.92 | 0.697 |
| Basal free wall | -24.95±2.84 | -23.77±3.19 | 0.275 |
| Mid free wall | -25.35±3.75 | -25.08±3.57 | 0.836 |
| Apical free wall | -17.8±2.75 | -18.15±2.85 | 0.724 |
| Free wall GLS | -22.98±2.37 | -22.16±2.68 | 0.367 |
| GLS | -20.24±2 | -19.42±2.47 | 0.299 |

## DISCUSSION

This study aimed to evaluate early right ventricular (RV) dysfunction in patients with anterior versus isolated inferior myocardial infarction (MI) following primary percutaneous coronary intervention (PCI). The findings indicated significant differences in RV function between the two groups, with anterior MI showing greater impairment compared to inferior MI.

**Baseline Characteristics**

The baseline clinical characteristics, including age, sex, comorbidities (diabetes, hypertension), smoking status, and dyslipidemia, were comparable between the anterior and inferior MI groups. This similarity in baseline characteristics allowed for a more accurate comparison of RV function parameters between the groups, minimizing potential confounding factors, and thereby supporting the generalizability of our findings. In our study, approximately 40% of patients with anterior MI had diabetes, which is slightly lower compared to the 43% reported by Rajesh et al,[]14 and 55% observed by El Sebaie and El Khateeb.[15] We reported that 45% of patients with anterior MI had hypertension, which is lower than the 50% reported by Rajesh et al,[14] and the 63% reported by El Sebaie and El Khateeb.[15] 48% of patients with anterior MI in our study were smokers, which is also lower than the 70% smoking prevalence reported by El Sebaie and El Khateeb.[15] This discrepancy may be due to



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differences in patient demographics or regional variations.

Echocardiographic Parameters and RV Dysfunction

Right ventricular dysfunction is more pronounced in anterior myocardial infarction (MI) than in inferior MI, despite the vascular anatomy and perfusion territories suggesting that inferior MI should have a greater impact on RV function. From a physiological standpoint, the distribution of perfusion territories supports the notion that inferior MI, typically caused by right coronary artery (RCA) stenosis, would significantly affect RV function. The RCA supplies the RV free wall and the basal portion of the interventricular septum, making it a primary determinant of RV perfusion and function. In contrast, anterior MI is predominantly due to left anterior descending artery (LAD) stenosis, which minimally contributes to RV perfusion except for the RV apex when the LAD wraps around the apex.[16]

In our study, anterior MI was associated with lower TAPSE, tricuspid annulus peak systolic velocity (S'), and more impaired RV myocardial performance index (RV MPI) by both pulse Doppler and tissue Doppler methods. In addition, global longitudinal strain (GLS) and free wall strain values were significantly more negative in the inferior MI group, indicating better RV contractility compared to the anterior MI group. The inferior MI group also demonstrated significantly better strain values across various segments of the basal, mid, and apical free walls.

In our study, there is reduced tricuspid annular plane systolic excursion (TAPSE) in the anterior MI group than inferior MI group. These findings align with those reported by Keskin et al, who investigated RV function in 350 patients with first-time anterior ST-segment elevation myocardial infarction (STEMI) and observed a significant reduction in RV systolic function, including TAPSE, in this subgroup.[17] In this study, TAPSE showed a positive correlation with left ventricular ejection fraction (LVEF), suggesting that the impaired LV systolic function in anterior MI directly affects RV systolic performance, irrespective of intrinsic RV contractility.

In our study, the myocardial performance index (MPI), measured using both pulsed and tissue Doppler imaging, was significantly higher in the anterior myocardial infarction (MI) group compared to the inferior MI group.

These findings are consistent with those reported by Ozturk et al,[18] who demonstrated a notable increase in MPI following anterior ST-segment elevation myocardial infarction (STEMI). The use of MPI, a load-independent parameter, provides a comprehensive assessment of global cardiac dysfunction and further underscores the greater functional compromise observed in anterior MI compared to inferior MI.

In our study, the systolic velocity of the lateral wall of the RV measured by tissue Doppler imaging (S′) was significantly lower in the anterior MI group compared to the inferior MI group. These findings are consistent with the observations of Hsu et al,[19] who reported reduced RV annular velocities, including S′, in patients with anterior ST-segment elevation myocardial infarction (STEMI) compared to those with inferior STEMI. The lower S′ values observed in anterior MI reflect the more extensive myocardial involvement and the interplay between left and right ventricular function.

**Troponin Levels and Correlation with RV Function**

The significantly higher troponin levels observed in anterior MI patients further highlight the greater extent of myocardial injury. The correlation between higher troponin levels and impaired RV GLS in our study underscores the critical role of myocardial injury severity in determining RV dysfunction.

**Vascular Territory and Multi-Vessel Disease**

Our findings demonstrated a distinct pattern of vascular involvement, with the LAD predominantly implicated in anterior MI and the RCA primarily involved in inferior MI. Multi-vessel disease in anterior MI patients was associated with significantly worse RV function, including more impaired GLS and free wall strain values, as well as lower LVEF, TAPSE, and tricuspid annulus S' values. This observation aligns with the work of Antoni et al,[20] who reported that multi-vessel disease exacerbates myocardial dysfunction and worsens clinical outcomes.

Interestingly, multi-vessel disease in inferior MI had a less pronounced impact on RV function, with only minor differences in basal septum strain and other parameters. This finding suggests that inferior MI's localized nature limits the extent of RV dysfunction even in the presence of additional vascular involvement.

**Gender Differences**

This suggests that RV function parameters, including systolic function (TAPSE, Tricuspid Annulus S'), myocardial performance indices, and strain measurements, are comparable between genders in this study population. This indicates that gender does not significantly influence the degree of RV dysfunction in the studied population.

**Correlation Between Quantitative Parameters**

The study also revealed significant correlations between RV strain parameters and other echocardiographic measures, such as LVEF, TAPSE, and tricuspid annulus S'. Reduced left ventricular function, reflected by lower LVEF was strongly associated with impaired RV strain values. Additionally, RV MPI by both pulse Doppler and tissue Doppler positively correlated with strain values, reinforcing its utility as a marker of RV dysfunction. These findings align with those reported by Antoni et al,[20] who identified a strong positive correlation between LVEF and TAPSE in patients with acute ST-segment elevation myocardial infarction (STEMI), irrespective of the infarction site.


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**Clinical Implications**

The results of this study underscore the importance of early recognition and management of RV dysfunction in anterior MI patients, who are at higher risk of adverse outcomes due to more extensive myocardial involvement. The significant impairments in strain values and other RV parameters highlight the need for routine echocardiographic evaluation, including strain imaging, in patients undergoing PCI for anterior MI.

**Limitations and recommendations**

This study has several limitations, including its single-center design with a relatively small patient population, which restricts generalizability. RV strain imaging was highly dependent on operator expertise and echocardiographic quality, potentially introducing variability and measurement bias. Exclusion of patients with advanced heart failure (Killip III/IV) limits applicability to the full spectrum of AMI. The timing of PCI, with early presenters likely having better RV function, may have influenced results. Additionally, the presence of severe non-culprit lesions in a significant proportion of patients (39% vs. 30% in inferior vs. anterior MI) may have acted as a confounding factor. To address these limitations, future studies should involve larger multicenter designs, standardized imaging protocols, and inclusion of broader patient populations. Moreover, controlling for confounding factors and investigating the impact of PCI timing on RV function are recommended to provide more robust and generalizable evidence.

## CONCLUSION

Based on above findings, we concluded that patients with anterior MI demonstrated significantly worse RV function, as evidenced by lower tricuspid annular plane systolic excursion (TAPSE), tricuspid annulus peak systolic velocity (S'), and more impaired global longitudinal strain (GLS) and RV free wall strain values compared to those with inferior MI. Additionally, anterior MI was associated with lower left ventricular ejection fraction (LVEF) and elevated myocardial performance index (RV MPI), suggesting greater overall cardiac dysfunction. The vascular territory affected in anterior MI primarily involved the left anterior descending artery (LAD), while inferior MI predominantly involved the right coronary artery (RCA). The findings underscore the more profound impact of anterior MI on right ventricular function compared to inferior MI, emphasizing the importance of early recognition and management of RV dysfunction in anterior MI.

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