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ORIGINAL RESEARCH

Association of Systemic Inflammatory Response Syndrome With Cardiovascular Events After Mitral Transcatheter Edge-to-Edge Repair

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BACKGROUND: Systemic inflammatory response syndrome (SIRS) following cardiovascular interventions is associated with adverse events during hospitalization and follow-up. Mitral transcatheter edge-to-edge repair is increasingly utilized for treatment of mitral regurgitation (MR). We investigated whether SIRS following mitral transcatheter edge-to-edge repair may occur and be associated with adverse clinical outcomes.

METHODS AND RESULTS: A total of 158 consecutive patients with severe MR undergoing mitral transcatheter edge-to-edge repair were studied. SIRS was defined by leukocytosis (≥12×10^9/L) and fever (≥38 °C) within 48 hours after intervention. Baseline inflammation was measured by absolute neutrophil and lymphocyte counts and neutrophil-lymphocyte ratio. The primary end point of major cardiovascular events was the composite of nonfatal myocardial infarction, nonfatal stroke, and all-cause death. Recurrent MR at follow-up was also recorded. The mean patient age was 80.8±8.8 years. Forty-four (27.9%) developed SIRS. Neutrophil-lymphocyte ratio correlated with onset of leukocytosis and fever (P=0.04). During a median follow-up of 12.5 (5.4–17.4) months, the primary end point occurred in 27 (17.1%) patients (6 myocardial infarction, 5 strokes, and 16 deaths). Patients with SIRS more often had severe MR (79.5% versus 62.7%, P=0.02) at follow-up. After adjustment for pertinent variables, SIRS (HR 2.73 [95% CI, 1.08–6.86]; P=0.03) was independently associated with major cardiovascular events.

CONCLUSIONS: SIRS after mitral transcatheter edge-to-edge repair is a strong independent predictor of major cardiovascular events. Closer follow-up is warranted because patients with SIRS have more severe MR at follow-up.

Key Words: left ventricular remodeling ■ major adverse cardiovascular events ■ mitral regurgitation ■ mitral transcatheter edge-to-edge repair ■ mitralclip ■ systemic inflammatory response syndrome

Mitral regurgitation (MR) affects 2%–3% of the population and up to 10% of individuals >75 years of age, and when severe is associated with considerable morbidity and mortality.[1] Approximately 10 000 transcatheter mitral valve interventions are performed yearly in the United States to treat patients with severe, symptomatic MR.[2] Over the last 2 decades, mitral transcatheter edge-to-edge repair (M-TEER) has emerged as a safe and effective treatment for MR, with >200 000 patients treated globally.[3] The

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CLINICAL PERSPECTIVE

What Is New?

- Systemic inflammatory response syndrome may occur following mitral transcatheter edge-to-edge repair and is an independent predictor of myocardial infarction, stroke, and death.
- Higher inflammation levels at baseline are present in patients who develop systemic inflammatory response syndrome after mitral transcatheter edge-to-edge repair.

What Are the Clinical Implications?

- Closer follow-up is warranted because patients with systemic inflammatory response syndrome have worse valvular and clinical outcomes.

Nonstandard Abbreviations and Acronyms

MACE	major adverse cardiovascular events
MR	mitral regurgitation
M-TEER	mitral transcatheter edge-to-edge repair
NLR	neutrophil-lymphocyte ratio
SIRS	systemic inflammatory response syndrome

Cardiovascular Outcomes Assessment of the MitraClip Percutaneous Therapy for Heart Failure Patients with Functional Mitral Regurgitation (COAPT) trial showed that in patients with heart failure and severe secondary MR, M-TEER combined with medical therapy reduced hospitalizations and all-cause mortality over 5 years compared with medical treatment alone.[4] This success paved the way for commercial availability of novel M-TEER devices, which extend the treatment option to patients with complex anatomy, expanding the application of this technology.[5]

Emerging data suggest that an inflammatory response following cardiovascular interventions is associated with adverse outcomes.[6] The development of a systemic inflammatory response (SIRS) in the first 48 hours following transcatheter aortic valve replacement (TAVR) is associated with increased 1-year mortality,[7] but no studies have described the frequency and impact of SIRS after M-TEER. The aims of the present study were to investigate the frequency of SIRS during the first 48 hours post-M-TEER, determine whether SIRS is associated with worse outcomes, and assess the association of SIRS with the frequency of recurrent severe MR at follow-up.

METHODS

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Study Design

Consecutive patients aged 18 years or older referred for M-TEER between January 2021 and December 2023 with ischemic or nonischemic cardiomyopathy (left ventricular ejection fraction 20%–50% and left ventricular end-systolic diameter <7 cm) and moderate-to-severe (grade 3+) or severe (grade 4) MR were included. All participants underwent comprehensive 2-dimensional and Doppler transthoracic echocardiography using commercially available ultrasound systems. Exclusion criteria include systemic inflammatory diseases, active malignancies, and active infections.

Conventional echocardiographic parameters were measured in accordance with the guidelines established by the American Society of Echocardiography.[8,9] The severity of MR and the decision to perform M-TEER were determined by consensus of a multidisciplinary heart team. Echocardiograms were interpreted by an expert structural echocardiographer (S.L.) with measurements performed without knowledge of the patients' clinical information.

The history, baseline clinical characteristics, echocardiographic and procedural details were recorded by treating physicians and extracted by review of electronic medical records. The observation period began on the date of intervention and continued until the date of last follow-up visit or death.

The study was approved by the institutional review board at the Icahn School of Medicine at Mount Sinai. Informed consent was waived due to the retrospective nature of the investigation.

End Points

The SIRS was defined by the following criteria during the first 48 hours after M-TEER: temperature <36.0 or >38.0 °C and leukocyte count ≥12 or <4 (10^9/L).[10] These criteria were selected based on their more robust association with SIRS, minimizing confounding factors such as pain or anxiety, which can also elevate respiratory rate and heart rate in the context of postintervention monitoring, as supported by previous studies.[11]

The primary end point was the development of a major adverse cardiovascular event (MACE), defined as the composite of nonfatal myocardial infarction, nonfatal stroke, and all-cause death after M-TEER. Inflammation was characterized as the absolute whole blood neutrophil count, absolute lymphocyte count, and the neutrophil-lymphocytes ratio (NLR).[12,13]

Patients were divided into quartiles of baseline NLR as previously reported.[12]

Follow-up data were obtained through review of medical records. Mortality data were confirmed through cross-referencing with the Limited Access Death Master File. In cases where patients were lost to follow-up, their data were censored at the time of their last known contact. Censoring was applied to ensure that these cases did not artificially affect the survival analysis results. Periprocedural complications were defined in accordance with the Valve Academic Research Consortium-3 definitions.[14]

Statistical Analysis

Continuous variables were expressed as the median and interquartile range. Categorical variables were presented as values and percentages. Comparison of baseline and echocardiographic characteristics were assessed using the Kruskal–Wallis test, Mann–Whitney *U* test, and Pearson χ^2 statistics, followed by post hoc analysis of between-group comparison with Bonferroni correction for multiple comparisons, as appropriate. Paired samples Wilcoxon signed-rank was used to analyze the changes in echocardiographic parameters, and McNemar's test was used to analyze the change in New York Heart Association functional classification before and after M-TEER.

Kaplan–Meier survival curves were constructed to analyze freedom from clinical outcomes between groups, and significance was compared using the log-rank test. Adjusted analysis was performed to investigate the independent association of SIRS and clinical outcomes after M-TEER. Variables included in the multivariable models were selected based on a combination of pre-existing knowledge and their statistical significance in univariate analysis (*P* value ≤0.20). Estimates are reported as hazard ratio (HR) and 95% CI. To ensure the validity of the proportional hazards assumption in our Cox regression models, we performed the Schoenfeld residuals test. The analysis was performed on 158 patients who had complete observations.

A 2-tailed *P* value <0.05 was considered statistically significant. All statistical calculations and analyses were performed with STATA (version 17, Stata Corp, College, TX).

RESULTS

Of 158 consecutive patients with severe MR who underwent M-TEER, the mean age was 80.8±8.8 years. One patient was lost to follow-up and was censored at the time of their last known follow-up. Their baseline clinical and echocardiographic characteristics stratified by the presence of SIRS are shown in Table 1 and Table 2. Forty-four patients (27.9%) developed SIRS. Compared with those without, patients with SIRS exhibited tachycardia (59% versus 29.3%, *P*=0.001), tachypnea (69.2% versus 37.2%, *P*=0.003), fever (23.1% versus 11.8%, *P*=0.09), and leukocytosis (27.0% versus 0.7%, *P*=0.0001; Table 3). After the procedure, the blood lactate concentration increased by 18.2% in those with SIRS versus 2.6% in those without SIRS (*P*=0.001). Acute kidney injury (AKI) was more frequent in patients with (14.3%) than without SIRS (6.1%; *P*=0.10). The frequency of developing SIRS did not differ based on the mechanism of MR, primary versus secondary (13.3% versus 14.6%; *P*=0.78).

SIRS postintervention was more often associated with severe MR during follow-up (79.5% versus 62.7%; *P*=0.02; Figure 1). There was no significant change in left ventricular ejection fraction postintervention compared with baseline either in patients developing SIRS (57 versus 55%, *P*=0.78) or those without SIRS (52 versus 53%, *P*=0.53).

Predictors of Systemic Inflammatory Response Syndrome

The results of logistic regression analysis seeking predictors of SIRS after M-TEER are shown in Table S1. Postprocedural elevation of blood lactate concentration was associated with the development of SIRS (*P*=0.003), as was the peripheral blood NLR (*P*=0.04), but there was no association with neutrophil count alone (*P*=0.10).

Clinical Outcomes of SIRS After M-TEER

Figure 2 presents the Kaplan–Meier curves for the composite primary outcome in patients with versus without SIRS. During a median follow-up of 12.5 (5.4–17.4) months, nonfatal myocardial infarction developed in 4% of cases (n=6), nonfatal stroke occurred in 3.3% (n=5), and all-cause death in 10.2% (n=16; Table 4). By univariate analysis, Euroscore II (*P*=0.03), Kansas City Cardiomyopathy Questionnaire (KCCQ-12) (*P*=0.002) and SIRS (*P*=0.05) were associated with the composite outcome. After adjustments, creatinine (HR 1.38 [95% CI, 1.05–1.81]; *P*=0.02), KCCQ 12 (HR 0.88 [95% CI, 0.81–0.96]; *P*=0.002), and SIRS (HR 2.73 [95% CI, 1.08–6.86]; *P*=0.03) remained associated with the composite outcome. There was no association between baseline neutrophil count or NLR and MACE (*P*=0.75 and 0.74, respectively).

DISCUSSION

In this study, we investigated the frequency of SIRS following M-TEER and its association with cardiovascular outcomes. During the first 48 hours after M-TEER, 44 patients (27.9%) developed SIRS, characterized by

Table 1. Demographic and Clinical Variables Based on the Presence of SIRS

	SIRS− (n=114)	SIRS+ (n=44)	*P* value
Age (y)	82 (76–87)	83 (75–87)	0.73
Male, n	56 (49.1)	27 (62.8)	0.15
Ethnicity			
White, n	62 (54.4)	27 (62.8)	0.32
Black, n	13 (11.4)	1 (2.3)	
Hispanics, n	10 (8.8)	3 (7)	
Others, n	29 (25.4)	12 (27.9)	
Mechanism of MR			
Primary, n	59 (37.3)	21 (13.3)	0.65
Secondary, n	55 (34.8)	23 (14.6)	
BMI, kg/m^2	25.4 (21.3–28.2)	25 (22.2–28.3)	0.70
History of smoking, n	27 (23.9)	8 (18.6)	0.5
CAD, n	71 (62.3)	25 (59.5)	0.85
History of CABG, n	28 (24.6)	8 (18.6)	0.53
History of PCI, n	39 (34.5%)	16 (37.2%)	0.85
History of CVA, n	22 (19.3%)	7 (16.3%)	0.82
PAD, n	25 (21.9%)	7 (16.3%)	0.51
Hypertension, n	105 (92.1%)	41 (95.3%)	0.73
Hyperlipidemia, n	95 (83.3%)	36 (83.7%)	>0.99
Diabetes, n	42 (36.8%)	11 (25.6%)	0.26
Atrial fibrillation, n	71 (62.3%)	25 (58.1%)	0.71
COPD, n	23 (20.2)	10 (23.3)	0.67
Pulmonary hypertension, n	32 (28.1)	10 (23.3)	0.69
Euro score II, %	4.6 (2.9–7.2)	4.2 (3.1–5.6)	0.50
KCCQ 12, n	29 (22–34)	26 (23–30)	0.30
6 min walking, m	600 (400–650)	500 (400–650)	0.7
BNP, pg/mL	405 (236.2–841.7)	250.8 (128.3–690.8)	0.03
NT-proBNP, pg/mL	4160 (1875.5–5796.5)	1760.5 (1190–8507)	0.61
Creatinine, mg/dL	1.1 (0.9–1.6)	1.3 (0.9–1.5)	0.84
NYHA			
II	14 (12.3)	3 (7)	0.46
III	91 (79.8)	38 (88.4)	
IV	9 (7.9)	2 (4.7)	
Antiplatelet agents, n	50 (43.9)	26 (60.5)	0.08
Anticoagulation, n	60 (52.6)	24 (55.8)	0.86
β-Blockers, n	87 (77.0%)	29 (67.4%)	0.23
CCB, n	19 (16.7%)	9 (20.9%)	0.64
ACE-I /ARBs, n	53 (46.5%)	15 (34.9%)	0.21
ARNI, n	24 (21.1)	9 (20.9)	>0.99
SGLT-2i, n	26 (22.8)	5 (11.6)	0.18
Loop diuretics	81 (71.1%)	29 (67.4%)	0.70
MRA, n	33 (28.9%)	13 (30.2%)	>0.99
Statin, n	88 (77.9%)	32 (74.4%)	0.67

Values are presented as median (25th–75th percentile) or n (%).

ACE-I indicates angiotensin-converting enzyme inhibitors; ARBs, angiotensin receptor blockers; ARNI, angiotensin receptor/neprilysin inhibitor; BMI, body mass index; BNP, brain natriuretic peptide; CABG, coronary artery bypass graft; CAD, coronary artery disease; CCB, calcium channel blockers; COPD, chronic obstructive pulmonary disease; CVA, cerebrovascular accident; KCCQ, Kansas City Cardiomyopathy Questionnaire; MR, mitral regurgitation; MRA, mineralocorticoid receptor antagonist; NT-proBNP, N-terminal pro–B-type natriuretic peptide; NYHA, New York Heart Association; PAD, peripheral artery disease; PCI, percutaneous coronary intervention; SGLT-2i, sodium-glucose cotransporter-2 inhibitors; and SIRS, systemic inflammatory response syndrome.

fever and leukocytosis. Basal inflammation, indicated by the NLR, was associated with SIRS postintervention. Patients who developed SIRS had more severe MR 12 months following intervention than those without SIRS. The development of SIRS was associated with an increased risk of the composite outcome of myocardial infarction, stroke, and all-cause death, although markers of inflammation at baseline (neutrophil count, lymphocyte count, and NLR) were not predictive of the composite MACE outcome (Figure 3).

SIRS after cardiovascular interventions was first reported among patients undergoing cardiovascular surgery, but has also been observed after various other interventional procedures, including endovascular thoracic aortic repair (EVAR/TEVAR), implantation of cardiac electrical devices, percutaneous coronary intervention, electrophysiological procedures, and TAVR, with incidence rates up to 50%.[6] In studies of patients undergoing TAVR,[11,15] EVAR,[16,17] and TEVAR,[18] SIRS was associated with lengthier hospitalizations

Table 2. Echocardiographic Variables

	SIRS− (n=114)	SIRS+ (n=44)	*P* value
LVEF, %	52 (36–64)	57 (45–63)	0.30
IVS, mm	11.0 (9.0–12.0)	11.0 (10.0–12.0)	0.94
LVPWT, mm	10.0 (9.0–11.0)	10.0 (9.0–11.0)	0.82
LVEDD, mm	52.0 (46.0–60.0)	52.0 (45.0–58.0)	0.57
LVESD, mm	36.0 (29.5–46.0)	34.0 (30.0–41.0)	0.24
LAVI, mm	60.9 (47.3–78.3)	59.7 (47.6–72.4)	0.43
E wave, cm/s	106 (89–130)	96 (82.5–111.0)	0.34
A wave, cm/s	65 (48–96)	74 (48–102)	0.48
≥ moderate TR, n	61 (35.7%)	27 (39.1%)	0.72
PASP, mm Hg	45 (37–57)	43.5 (34–56)	0.56
EROA, cm^2	0.44 (0.32–0.60)	0.45 (0.35–0.61)	0.69
Regurgitant volume, mL	69 (54–90)	74 (58–108)	0.19
Mitral valve area, cm^2	5.2 (4.5–6.4)	4.6 (4.2–5.6)	0.10

EROA indicates effective regurgitant orifice area; IVS, interventricular septum; LAVI, left atrial maximum volume index; LVEDD, left ventricular end-diastolic diameter; LVEF, left ventricular ejection fraction; LVESD, left ventricular end-systolic diameter; LVPWT, left ventricular posterior wall thickness; PASP, pulmonary arterial systolic pressure; SIRS, systemic inflammatory response syndrome; and TR, tricuspid regurgitation.

Table 3. Periprocedural Complications After M-TEER

	SIRS– (n=114)	SIRS+ (n=44)	*P* value
AKI	7 (6.1)	6 (14.3)	0.10
Lactate	3 (2.6)	8 (18.2)	0.001
Tachycardia	29 (29.3)	23 (59.0)	0.001
Tachypnea	38 (37.3)	27 (69.2)	0.003
Fever	12 (11.8)	9 (23.1)	0.09
Leukocytosis	1 (0.7)	38 (27.0)	0.0001

AKI indicates acute kidney injury; M-TEER, mitral transcatheter edge-to-edge repair; and SIRS, systemic inflammatory response syndrome.

and higher risks of procedure-related complications, including cardiac tamponade, bleeding, and acute kidney injury,[19] which contribute to heightened in-hospital and 30-day mortality.[20,21] The onset of SIRS is associated with certain procedural interventions, such as repeated ventricular pacing, postdilatation of valve prostheses, and episodes of hypotension.[7] The intensity of the inflammatory response post-TAVR may be related to surgical access, with a transapical approach eliciting greater reaction than a transfemoral approach,[22,23] and valve type, with balloon- and self-expandable valves more often associated with post-procedural SIRS. Despite some evidence of SIRS after M-TEER,[24] the frequency and impact of SIRS following M-TEER have not been reported previously. We found

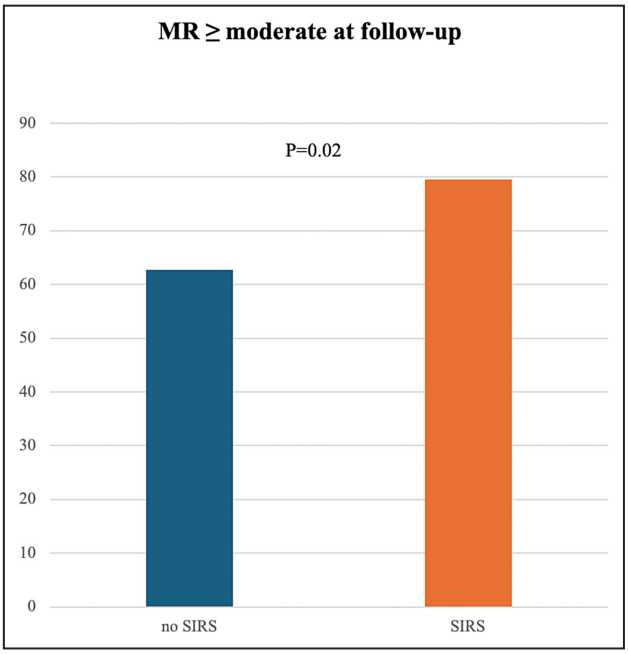

Figure 1. MR severity change based on the presence of SIRS at follow-up.
Impact of SIRS on mitral regurgitation severity post–mitral transcatheter edge-to-edge repair. Patients with SIRS more often had severe MR (79.5% vs 62.7%, *P*=0.02) at follow-up. MR indicates mitral regurgitation; and SIRS, systemic inflammatory response syndrome.

that SIRS developed in nearly one-third of patients following M-TEER, similar to the frequency observed following TAVR.[7]

Although the pathogenesis of SIRS postcardiovascular interventions is incompletely understood, several mechanisms and risk factors have been recognized. SIRS may stem from preprocedural inflammation,[11] endothelial injury, and leukocyte activation, which are associated with the biomaterials of implanted devices such as woven polyester, and procedural factors such as vascular trauma,[25] sustained hypotension,[26] manipulation of thrombus,[27] and exposure to contrast media.[28]

An analysis of 5 clinical trials found an association between baseline inflammation and worse cardiovascular outcomes, with NLR predictive of MACE.[12] In patients undergoing TAVR, baseline inflammation, indicated by C-reactive protein levels, interleukin 6, monocytes, and lymphocyte Th2, were associated with increased all-cause mortality, suggesting that integration of inflammation and immune function assessments could facilitate preprocedural risk stratification.[11] In patients undergoing M-TEER, we found that NLR was associated with SIRS but not with MACE. Previous studies showed that patients with MR have high inflammation levels, particularly in the case of primary MR.[29,30] Furthermore, other coexisting medical conditions, such as heart failure and coronary artery disease, contribute to the presence of a pro-inflammatory state.[31] Our findings suggest that a pre-existing inflammatory state is a contributing factor to the development of SIRS postprocedure; therefore, assessing baseline inflammation may help identify patients at higher risk of developing SIRS following M-TEER. While higher baseline inflammation levels should prompt closer evaluation and monitoring, they do not directly predict worse outcomes, leaving uncertainty about the possible benefit of the integration of pre-inflammation levels or the use of anti-inflammatory treatments in patients undergoing M-TEER.

Suboptimal organ perfusion during the procedure has been considered another key mechanism leading to postprocedural SIRS. Although the association of hypoperfusion and inflammation was initially described in patients undergoing cardiopulmonary bypass,[32] similar observations have been made in patients with cardiogenic shock[33] and in those undergoing TAVR.[15] The vascular trauma and brief periods of hypotension in these circumstances induce the release of inflammatory cytokines from endothelial tissue.[34] The myocardium, kidneys, and gastrointestinal tract are repositories of inflammatory cytokines released in response to hypotension, amplifying and prolonging inflammation.[35,36] We found that patients with SIRS were more likely to develop acute kidney injury and had higher blood lactate levels than those without

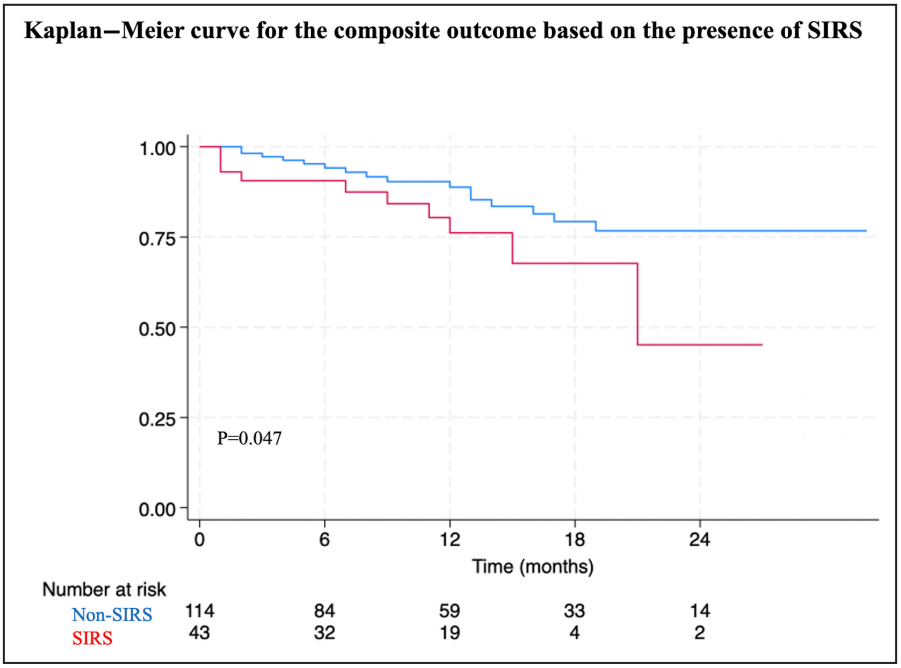

Figure 2. Kaplan–Meier survival curves.
The primary end point of major cardiovascular events was the composite of nonfatal myocardial infarction, nonfatal stroke, and all-cause death. Kaplan–Meier survival curves were constructed to analyze freedom from clinical outcomes between groups, and significance was compared using the log-rank test. Adjusted analysis was performed to investigate the independent association of SIRS and clinical outcomes after M-TEER. During a median follow-up of 12.5 (5.4–17.4) months, the primary end point occurred in 27 (17.1%) patients (6 MI, 5 strokes, and 16 deaths). MI indicates myocardial infarction; M-TEER, mitral transcatheter edge-to-edge repair; and SIRS, systemic inflammatory response syndrome.

SIRS, suggesting ischemic injury as a mechanism of the inflammatory response following M-TEER. This reinforces the hypothesis that procedural factors, particularly ischemia and reperfusion injury, may trigger the development of SIRS.

The material composition of devices used in endovascular and endocardial interventions may play a role in the inflammatory response.[37] In patients undergoing EVAR and TEVAR, polytetrafluorethylene and woven polyester components of stent-grafts

Table 4. Association of SIRS With the Composite Outcome After M-TEER

	Univariate model		Multivariate model	
	HR (95% CI)	*P* value	HR (95% CI)	*P* value
Age (per 1-y increase)	1.01 (0.96–1.06)	0.69		
Sex	0.98 (0.44–2.14)	0.95		
Atrial fibrillation	1.74 (0.69–4.37)	0.24		
CAD	1.79 (0.74–4.28)	0.19	1.54 (0.58–4.07)	0.38
NYHA ≥3	2.11 (0.28–15.71)	0.46		
Pulmonary hypertension	0.87 (0.35–2.19)	0.77		
Euroscore (per 1% increase)	1.06 (1.01–1.12)	0.03	1.04 (0.98–1.10)	0.24
Creatinine mg/dL	1.19 (0.97–1.45)	0.09	1.38 (1.05–1.81)	0.02
KCCQ 12	0.89 (0.83–0.96)	0.002	0.88 (0.81–0.96)	0.002
LVEF (per 1% increase)	1.00 (0.97–1.03)	0.91		
≥Moderate TR	1.07 (0.48–2.4)	0.86		
SIRS	2.21 (1.00–4.94)	0.05	2.73 (1.08–6.86)	0.03

CAD indicates coronary artery disease; HR, hazard ratio; KCCQ, Kansas City Cardiomyopathy Questionnaire; LVEF, left ventricular ejection fraction; M-TEER, mitral transcatheter edge-to-edge repair; NYHA, New York Heart Association; SIRS, systemic inflammatory response syndrome; and TR, tricuspid regurgitation.

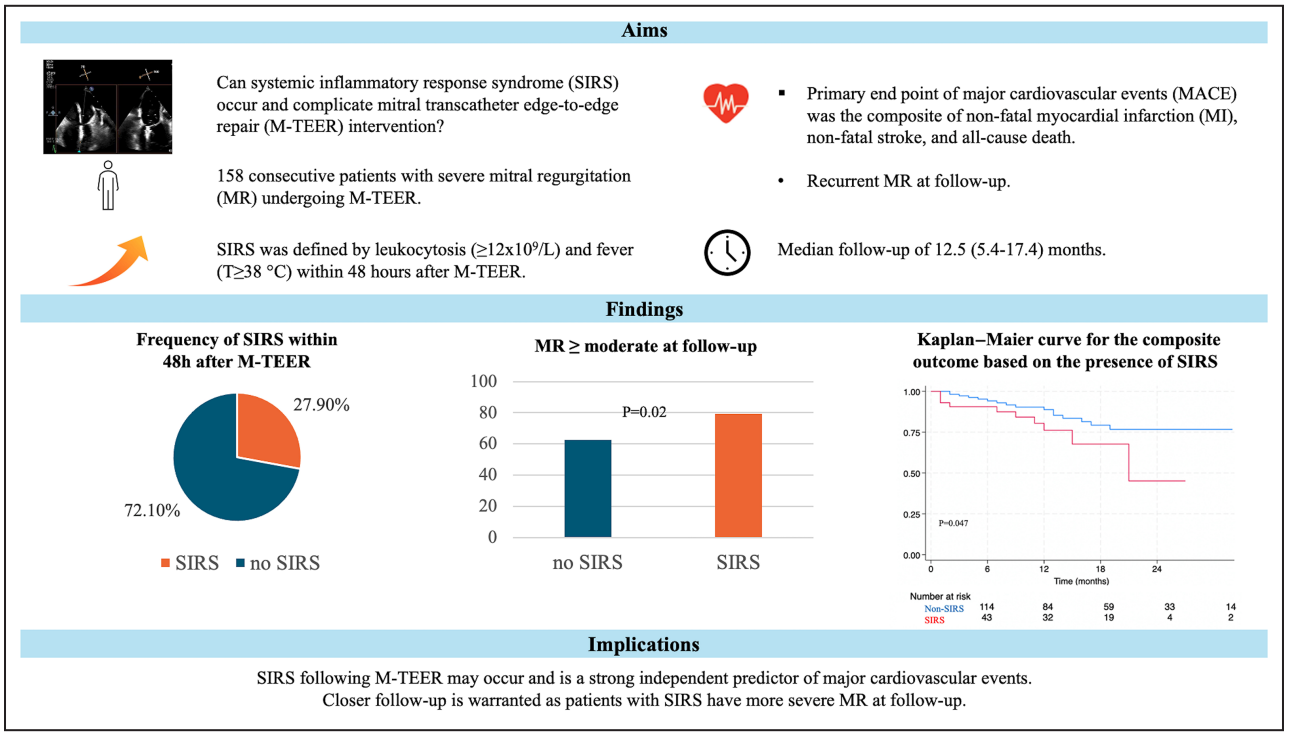

Figure 3. Frequency and impact of SIRS following M-TEER in patients with severe MR.
MR indicates mitral regurgitation; M-TEER, mitral transcatheter edge-to-edge repair; and SIRS, systemic inflammatory response syndrome.

have been associated with inflammatory reactions. The metallic structure of the Mitra-Clip device has components containing a high-strength alloy (Elgiloy), nitinol, and/or woven polyester. The polyester in gripper arms, legs, and threaded studs induces a biphasic inflammatory response, leading to the deposition of granulation tissue and collagen-rich neointima.[38] Whether an exaggerated inflammatory response induced by these materials is pertinent to the pathogenesis of SIRS is a hypothesis requiring future investigation.

The potential for SIRS following cardiovascular interventions necessitates the development of standardized diagnostic criteria for early recognition, clinical monitoring, and effective treatment. As M-TEER becomes more widely used for the treatment of MR, more data regarding the association of this procedure and SIRS will become available in the future. Our findings, demonstrating the frequency of SIRS following M-TEER and its association with adverse outcomes, including an increased risk of MACE, call for better preprocedural risk stratification and prompt recognition of the syndrome to reduce complications. Additional research is needed to understand the pathophysiological processes underlying the development of SIRS following M-TEER, explore potential prophylactic or therapeutic strategies, and guide the type and timing of follow-up to improve outcomes.

Strengths and Limitations

This is the first study to investigate the development of SIRS following M-TEER and serves as a starting point for hypothesis-driven research. Confirmation in larger cohorts and diverse populations and procedural methodologies are needed to better characterize the factors leading to the development of SIRS and mechanisms responsible for its association with severe adverse outcomes. Our study was underpowered to clearly distinguish the incidence and implications of SIRS following M-TEER in patients with primary versus secondary MR and in those undergoing M-TEER concurrently or following other endocardial interventions or percutaneous revascularization. Additionally, it is necessary to determine whether the frequency and severity of postprocedural SIRS are consistent across various types of transcatheter mitral valve interventions and whether these differ in patients undergoing M-TEER versus other catheter-based therapies for MR. Despite these limitations, our study highlights the prognostic potential of leukocyte counts and fever in predicting SIRS and adverse outcomes in patients following M-TEER, which is increasingly relevant to refining postprocedural care.

CONCLUSIONS

Systemic inflammatory response syndrome may occur following M-TEER and is an independent predictor

of myocardial infarction, stroke, and death. The development of SIRS can be easily identified by clinical parameters such as leukocytosis and fever following the procedure. Patients with higher baseline levels of inflammation seem at higher risk of developing SIRS. Closer follow-up is warranted because patients with SIRS have worse valvular and clinical outcomes.

ARTICLE INFORMATION

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Disclosures

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Supplemental Material

Table S1

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