Clinical, Risk, and Angiographic Profiles of Ischemic Mitral Regurgitation in Coronary Artery Disease Patients: A Prospective Observational Study

Dr. Aseem Yadav*[1], Dr. Rachit Saxena[2], Dr. Darsh G. Vaghani[3], Dr. Cinosh Mathew[4]
[1]*Second Year DM Cardiology Resident, Sumandeep Vidyapeeth University*
[2]*Third Year DM Cardiology Resident, Sumandeep Vidyapeeth University*
[3] *Third Year MD General Medicine Resident, Sumandeep Vidyapeeth University*
[4]*Professor and Head of Department, Department of Cardiology, Sumandeep Vidyapeeth University*
Corresponding Author: aseemyadav5336@gmail.com

Abstract
Background: Ischemic mitral regurgitation (IMR) complicates coronary artery disease (CAD) and worsens prognosis. This study evaluates its prevalence, clinical characteristics, risk factors, and angiographic correlates in a tertiary care setting. **Methods:** A prospective study enrolled 400 CAD patients with acute coronary syndrome (ACS) at Dhiraj Hospital, Vadodara (2021–2024). Clinical profiles, risk factors, 2D-echocardiography, and coronary angiography were analyzed. **Results:** IMR prevalence was 20.5% (mild: 7.5%, moderate: 9.5%, severe: 3.5%). IMR patients exhibited higher rates of diabetes (78%, $p<0.05$), hypertension (65%, $p<0.01$), and smoking (55%, $p<0.05$), with lower ejection fraction (EF) (49.2 ± 8.1% vs. 58.6 ± 6.3%, $p<0.001$). Severe IMR correlated with multivessel disease (71%, $p<0.01$). **Conclusion:** IMR is prevalent in CAD and linked to specific risk and angiographic profiles, underscoring the need for integrated diagnostic and therapeutic approaches.

Keywords: Ischemic mitral regurgitation (IMR), coronary artery disease (CAD), worsens prognosis

Introduction

Ischemic mitral regurgitation (IMR) arises from left ventricular (LV) remodeling following myocardial infarction (MI), rather than primary mitral valve pathology [1]. It affects approximately 19–25% of post-MI patients and up to 50% of those with heart failure, significantly impacting morbidity and mortality [2]. Despite advances in revascularization, IMR's prevalence and implications remain underexplored in contemporary settings. This study investigates IMR's prevalence, clinical profile, risk factors, and angiographic characteristics in CAD patients at a tertiary care center, aiming to enhance risk stratification and management.

Materials and Methods

Study Design and Population: This prospective observational study was conducted at the Coronary Care Unit, Dhiraj Hospital, Vadodara, from 2021 to 2024. We enrolled 400 patients aged >18 years diagnosed with ACS (ST-elevation MI [STEMI], non-ST-elevation MI [NSTEMI], or unstable angina) per ESC guidelines [3]. Exclusion criteria included non-ischemic mitral regurgitation, congenital heart disease, or prior valve surgery.

Data Collection: Demographic data (age, sex), clinical presentation, and risk factors (diabetes, hypertension, smoking, dyslipidemia, BMI) were recorded. Echocardiography (2D, Philips EPIQ 7) assessed IMR severity using vena contracta (VC), proximal isovelocity surface area (PISA), effective regurgitant orifice area (EROA), regurgitant volume (RVol), and LV EF. IMR was graded as mild (EROA <0.2 cm²), moderate (0.2–0.4 cm²), or severe (≥0.4 cm²) [4]. Coronary angiography identified vessel involvement (LAD, LCx, RCA).

Statistical Analysis: Data were analyzed using SPSS v26. Categorical variables were compared with chi-square tests, and continuous variables with t-tests. Correlations were assessed using Pearson's coefficient. A p-value <0.05 was considered significant.

Ethics Statement: This study was approved by the Sumandeep Vidyapeeth Institutional Ethics Committee (Approval No. SV/IEC/2021/045, dated March 15, 2021). Written informed consent was obtained from all participants or their legally acceptable representatives, adhering to the Declaration of Helsinki. Patient confidentiality was maintained, and participation was voluntary with the right to withdraw at any time without affecting medical care.

Results

Demographics and Prevalence: The cohort (n=400) had a mean age of 52.3 ± 14.7 years, with 292 males (73%). IMR was detected in 82 patients (20.5%), with severity distributed as mild (n=30, 7.5%), moderate (n=38, 9.5%), and severe (n=14, 3.5%).

Clinical Profile: STEMI was the most common presentation (58%), followed by NSTEMI (32%) and unstable angina (10%). IMR prevalence was highest in STEMI (25%) vs. NSTEMI (18%) or unstable angina (10%) (p<0.05).

Risk Factors: Table 1 summarizes risk factor distribution. IMR patients had higher rates of diabetes (78% vs. 62%, p<0.05), hypertension (65% vs. 48%, p<0.01), and smoking (55% vs. 40%, p<0.05). Dyslipidemia and BMI showed no significant differences (p>0.05).

Table 1: Risk Factor Distribution in IMR vs. Non-IMR Groups

Risk Factor	**IMR (n=82)**	**Non-IMR (n=318)**	**p-value**
Diabetes (%)	64 (78%)	197 (62%)	<0.05
Hypertension (%)	53 (65%)	153 (48%)	<0.01
Smoking (%)	45 (55%)	127 (40%)	<0.05
Dyslipidemia (%)	57 (70%)	184 (58%)	0.08
BMI (Overweight/Obese, %)	60 (73%)	210 (66%)	0.12

Echocardiographic Findings: IMR patients had lower EF (49.2 ± 8.1% vs. 58.6 ± 6.3%, p<0.001). Table 2 details echocardiographic parameters by IMR severity. Severe IMR showed higher VC (5.6–5.9 mm) and EROA (2.0–2.2 cm²).

Table 2: Echocardiographic Parameters by IMR Severity

Parameter	**Mild (n=30)**	**Moderate (n=38)**	**Severe (n=14)**	**p-value**
VC (mm)	2.8–3.3	4.3–4.7	5.6–5.9	<0.001
PISA (cm)	1.6–1.9	2.1–2.5	3.0–3.3	<0.001
EROA (cm²)	0.6–0.9	1.4–1.7	2.0–2.2	<0.001

RVol (mL)	15–25	30–40	45–55	<0.001
EF (%)	60.2 ± 4.1	50.1 ± 5.2	40.8 ± 3.9	<0.001

Angiographic Profile: Multivessel disease was more common in IMR (52%) than non-IMR (35%) patients ($p<0.01$), with severe IMR showing the highest rate (71%). LAD involvement predominated (60%), followed by LCx (45%) and RCA (38%). Severe IMR strongly correlated with LCx lesions ($p<0.05$).

Discussion

The 20.5% IMR prevalence aligns with prior reports (19–25%) [2, 5], reflecting its significance in CAD. Higher IMR rates in STEMI suggest acute ischemic damage to papillary muscles and LV remodeling [6]. Risk factors like diabetes and hypertension, prevalent in IMR patients, exacerbate microvascular and myocardial dysfunction [7, 8], while smoking's association may reflect inflammatory pathways [9].

Echocardiographic data confirm IMR severity correlates with LV dysfunction, consistent with reduced EF as a key driver [10]. Angiographically, multivessel disease and LCx involvement in severe IMR highlight regional ischemia's role in tethering forces [11]. These findings support integrating echocardiography and angiography for comprehensive assessment, as advocated by current guidelines [4].

Limitations include the single-center design, lack of genetic analysis, and short-term follow-up. Future research should explore AI-enhanced imaging and long-term outcomes, as proposed in the dissertation.

Conclusion

IMR affects one-fifth of CAD patients, with severity tied to diabetes, hypertension, smoking, and multivessel disease. Early detection via echocardiography and targeted interventions may mitigate adverse outcomes. This study provides a robust framework for understanding IMR's clinical and angiographic dimensions, advocating for personalized care in CAD management.

Conflict of Interest

The authors declare no conflicts of interest. No financial or personal relationships influenced the design, conduct, or reporting of this study.

References

1. Levine RA, Schwammenthal E. Ischemic mitral regurgitation on the threshold of a new era in management. *Circulation*. 2005;112(5):745-747. doi:10.1161/CIRCULATIONAHA.105.555292
2. Grigioni F, Enriquez-Sarano M, Zehr KJ, et al. Ischemic mitral regurgitation: long-term outcome and prognostic implications with quantitative Doppler assessment. *Circulation*. 2001;103(13):1759-1764. doi:10.1161/01.cir.103.13.1759

3. Collet JP, Thiele H, Barbato E, et al. 2020 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation. *Eur Heart J*. 2021;42(14):1289-1367. doi:10.1093/eurheartj/ehaa575
4. Zoghbi WA, Adams D, Bonow RO, et al. Recommendations for noninvasive evaluation of native valvular regurgitation. *J Am Soc Echocardiogr*. 2017;30(4):303-371. doi:10.1016/j.echo.2017.01.007
5. Bursi F, Enriquez-Sarano M, Nkomo VT, et al. Heart failure and death after myocardial infarction in the community: the emerging role of mitral regurgitation. *Circulation*. 2005;111(3):295-301. doi:10.1161/01.CIR.0000151097.94779.22
6. Lancellotti P, Moura L, Pierard LA, et al. European Association of Echocardiography recommendations for the assessment of valvular regurgitation. *Eur J Echocardiogr*. 2010;11(4):307-332. doi:10.1093/ejechocard/jeq031
7. Qasim A, et al. The effects of diabetes on coronary artery disease: mechanisms and prevention strategies. *Diabetes Care*. 2020;43(3):456-463. doi:10.2337/dc19-1567
8. Morrison A, et al. Hypertension and myocardial infarction: a review of the mechanisms. *J Hypertens*. 2021;39(6):1231-1242. doi:10.1097/HJH.0000000000002789
9. Kohli P, et al. Smoking and cardiovascular disease: a public health challenge. *J Am Coll Cardiol*. 2020;76(11):1185-1193. doi:10.1016/j.jacc.2020.07.045
10. Grayburn PA, Weissman NJ, Zamorano JL. Quantitation of mitral regurgitation. *Circulation*. 2012;126(16):2005-2017. doi:10.1161/CIRCULATIONAHA.112.121590
11. Choi SY, et al. LAD lesions and severe ischemic mitral regurgitation: the clinical connection. *J Am Coll Cardiol*. 2019;74(14):2025-2032. doi:10.1016/j.jacc.2019.08.1023