Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v6i4.1668
*Biol. Clin. Sci. Res. J., Volume 6(4), **2025**: 1668*
Original Research Article

Frequency of Myocardial Bridging in Patients With Coronary Artery Disease Undergoing CT Angiography

Komal Mushtaq*, Nazahat Pasha, Umama Zafar

Department of Radiology, Ch Pervaiz Elahi Institute of Cardiology, Multan, Pakistan
**Corresponding author's email address:* komalmushtaq12345@gmail.com

(Received, 24th January 2025, Accepted 12th April 2025, Published 30th April 2025)

Abstract: *Coronary artery disease (CAD) is a major cause of morbidity and mortality in South Asia, including Pakistan. Myocardial bridging (MB), a condition where a coronary artery tunnels through the myocardium, has been linked to myocardial ischemia and arrhythmias. This study aimed to determine the prevalence of MB in patients with atherosclerotic CAD undergoing CT coronary angiography in a tertiary care hospital in Pakistan.* ***Methods:*** *Chaudhry Pervaiz Elahi Institute of Cardiology, Multan, conducted a descriptive cross-sectional study from July to December 2024. A total of 181 patients aged 40–70 years with a clinical diagnosis of atherosclerotic CAD were enrolled. Myocardial bridging was assessed using 64-slice multi-detector CT angiography. Data were analyzed using SPSS version 25, and associations between clinical variables and MB were determined using Chi-square tests.* ***Results:*** *The mean age of participants was 57.3 ± 8.1 years, with a male predominance (56.9%). Hypertension was the most common comorbidity (64.6%). Myocardial bridging was detected in 18 patients (9.9%), with the mid-segment of the left anterior descending (LAD) artery being the most commonly involved (77.8%). No significant associations were found between MB and clinical risk factors ($p > 0.05$).* ***Conclusion:*** *Myocardial bridging was present in 9.9% of CAD patients, with the mid-LAD segment being most commonly affected. Given the diagnostic accuracy of CT coronary angiography, its use in CAD assessments may aid in detecting this clinically significant anomaly.*

Keywords: Coronary artery disease, myocardial bridging, CT coronary angiography, atherosclerosis, Pakistan, prevalence

[***How to Cite:*** Mushtaq K, Pasha N, Zafar U. Frequency of myocardial bridging in patients with coronary artery disease undergoing ct angiography. *Biol. Clin. Sci. Res. J.*, **2025;** 6(4): 77-79. doi: https://doi.org/10.54112/bcsrj.v6i4.1668

Introduction

Coronary artery disease (CAD) remains one of the leading causes of morbidity and mortality worldwide, with a particularly high burden in South Asia, including Pakistan, where lifestyle, genetic, and socioeconomic factors contribute to its prevalence. The Pakistani population is experiencing a significant rise in cardiovascular diseases, with recent estimates showing a 30–40% increase in the incidence of ischemic heart disease over the last decade due to rapid urbanization, dietary habits, and inadequate preventive strategies (1,2). One anatomical anomaly often overlooked but clinically significant in CAD patients is myocardial bridging (MB), a congenital condition in which a segment of a coronary artery—typically the left anterior descending (LAD) artery—tunnels through the myocardium rather than resting on its surface.

Myocardial bridging, although historically considered benign, has been increasingly associated with myocardial ischemia, arrhythmias, acute coronary syndromes, and even sudden cardiac death in certain populations (3,4). The advent of multi-detector computed tomography (MDCT), particularly 64-slice CT coronary angiography, has revolutionized the non-invasive detection of MB, enabling accurate visualization of the coronary anatomy, myocardial tunnels, and atherosclerotic plaques (5,6). Studies have reported varied prevalence of MB, ranging from 5% to 40% depending on the diagnostic modality and population studied (7,8). In South Asian settings, data regarding the frequency and clinical relevance of MB remain limited, especially in patients with pre-existing atherosclerotic disease.

In Pakistan, where cardiac imaging infrastructure has improved significantly in recent years, CT coronary angiography has become a reliable tool for CAD assessment. However, few local studies have assessed the frequency and implications of MB among Pakistani patients with established CAD, creating a gap in region-specific data needed to inform cardiological practice (9). With increasing access to CT angiography in tertiary care centers like Chaudhry Pervaiz Elahi Institute of Cardiology, Multan, there is an opportunity better to understand anatomical variants and their relevance to clinical management.

This study's importance lies in its potential to contribute to early diagnosis, risk stratification, and tailored management of CAD patients. Identifying the frequency of MB in this high-risk group may support more comprehensive cardiac evaluations and influence treatment decisions, such as avoiding certain medications like nitrates, which can exacerbate symptoms in MB patients (10). Therefore, this study aims to determine the prevalence of myocardial bridging in patients with atherosclerotic CAD undergoing CT coronary angiography in a tertiary care hospital in Pakistan.

Methodology

This descriptive cross-sectional study was conducted at the Department of Radiology, Chaudhry Pervaiz Elahi Institute of Cardiology (CPEIC), Multan. It aimed to determine the frequency of myocardial bridging in patients with atherosclerotic coronary artery disease undergoing CT coronary angiography. The study lasted six months from July 2024 to December 2024, and data collection was completed after receiving approval from the hospital's institutional review board.

One hundred eighty-one patients were enrolled in the study through non-probability consecutive sampling. Inclusion criteria included both male and female patients aged between 40 and 70 years with a clinical diagnosis of atherosclerotic coronary artery disease who were referred for CT coronary angiography at the institution. Patients who had previously undergone coronary artery bypass grafting (CABG), those with contraindications to contrast agents, and individuals with non-atherosclerotic cardiac pathologies were excluded from the study to maintain a homogenous sample relevant to the primary objective.

CT coronary angiography was performed using a 64-slice multi-detector computed tomography (MDCT) scanner. If required, patients were prepared according to standard cardiac imaging protocols, including heart

rate control using beta-blockers. Contrast-enhanced scans were obtained, and the coronary arteries were evaluated in multiple planes for myocardial bridging, defined as an intramyocardial course of a coronary artery segment, most commonly affecting the mid-left anterior descending (LAD) artery. Two experienced radiologists reviewed all images independently to reduce observer bias, and discrepancies were resolved by consensus.

Data were collected using a structured proforma, including demographic information (age, gender), clinical risk factors (diabetes mellitus, hypertension, smoking status, BMI), and imaging findings. The collected data were entered and analyzed using SPSS version 25. Categorical variables were summarized using frequencies and percentages, while continuous variables were presented as means and standard deviations. Chi-square tests were applied to determine associations between myocardial bridging and other clinical variables, with a p-value < 0.05 considered statistically significant.

Results

One hundred eighty-one patients were enrolled in this cross-sectional study conducted at the Department of Radiology, Chaudhry Pervaiz Elahi Institute of Cardiology (CPEIC), Multan. The study participants comprised individuals aged 40–70 years with a clinical diagnosis of atherosclerotic coronary artery disease (CAD) and referred for CT coronary angiography. The mean age of the participants was 57.3 ± 8.1 **years**, with a slight male predominance (n = 103, 56.9%).

Table 1 summarizes the demographic and clinical characteristics of the patients. A significant proportion of the patients were hypertensive (64.6%), while diabetes mellitus and smoking history were present in 40.9% and 35.4% of the study population, respectively. Obesity (BMI > 27.5 kg/m²) was noted in 45.9% of patients.

Based on CT coronary angiography, myocardial bridging (MB) was detected in 18 patients (9.9%). The most commonly involved vessel was the mid-segment of the left anterior descending (LAD) artery (77.8%).

Table 2 shows that among 181 patients, myocardial bridging (MB) was most commonly found in the mid-segment of the left anterior descending (LAD) artery (77.8%, 14 out of 18 cases), followed by the distal segment of the LAD (16.7%, 3 out of 18 cases) and the right coronary artery (RCA) (5.5%, 1 out of 18 cases). Table 3 presents the association between clinical variables and MB. Of the 18 patients with MB, 61.1% were male and 38.9% were female, with no significant gender difference (p = 0.74). Nine MB patients were over 60 (12.2%), but age was not significantly associated with MB (p = 0.32). Diabetes was present in 9.5%, hypertension in 11.1%, and smoking in 12.5% of MB patients, with no significant associations (p > 0.05). Obesity (BMI > 27.5) was present in 12.0% of MB patients, but this also did not show a significant association (p = 0.41).

Table 1: Demographic and Clinical Characteristics of Patients (n = 181)

Variable	Frequency (n)	Percentage (%)
Gender		
Male	103	56.9
Female	78	43.1
Age (years)		
40–49	42	23.2
50–59	65	35.9
60–70	74	40.9
Diabetes Mellitus		
Yes	74	40.9
No	107	59.1
Hypertension		
Yes	117	64.6
No	64	35.4
Smoking History		
Yes	64	35.4
No	117	64.6
BMI > 27.5 (Obese)	83	45.9

Table 2: Distribution of Myocardial Bridging Among Patients (n = 181)

Coronary Segment Involved	MB Present (n)	Percentage (%)
LAD - Mid Segment	14	77.8
LAD - Distal Segment	3	16.7
RCA	1	5.5
Total MB Cases	18	100

Table 3: Association between Clinical Variables and Myocardial Bridging

Variable	MB Present (n=18)	MB Absent (n=163)	p-value (Chi-square)
Male	11 (10.7%)	92 (89.3%)	0.74
Female	7 (9.0%)	71 (91.0%)	0.58
Age > 60 years	9 (12.2%)	65 (87.8%)	0.32
Diabetes Mellitus	7 (9.5%)	67 (90.5%)	0.91
Hypertension	13 (11.1%)	104 (88.9%)	0.56
Smoking	8 (12.5%)	56 (87.5%)	0.44
BMI > 27.5	10 (12.0%)	73 (88.0%)	0.41

Discussion

This study aimed to determine the frequency and clinical characteristics of myocardial bridging (MB) in patients with atherosclerotic coronary artery disease (CAD) undergoing CT coronary angiography at a tertiary care hospital in Pakistan. Our findings revealed that myocardial bridging was present in 19.9% of patients (36 out of 181), aligning with previous literature that reports a prevalence range from 5% to 40% depending on the population and diagnostic modality used(11).

In our study, the most commonly involved vessel was the left anterior descending artery (LAD), affected in 80.5% (29 out of 36) of MB cases. This finding is consistent with the results of Wang et al., who reported LAD involvement in 77% of bridging cases using coronary CT angiography (12). Similarly, Al-Sadawi et al. documented that LAD is the predominant site of MB, especially in patients with coexisting atherosclerosis, emphasizing the clinical significance of its detection in this context (13).

The frequency of MB in our Pakistani cohort (19.9%) falls within the mid-to-higher end of the range observed in other populations. For example, Habib et al. reported an 18.5% MB prevalence among Pakistani patients in a similar CT-based study at a different tertiary care centre (14). On the other hand, a meta-analysis by Wang et al. including both Western and Asian populations showed a pooled MB prevalence of approximately 15% using non-invasive imaging, slightly lower than our observation(12). These variations may be attributed to ethnic, genetic, and methodological differences, including the sensitivity of the imaging technique used.

Interestingly, we observed a higher prevalence of MB among males (61.1%) compared to females (38.9%), which mirrors the gender distribution found in the study by Erkilic et al., who noted male predominance in MB cases (male-to-female ratio of 1.6:1)(15). This gender pattern suggests possible hormonal or structural cardiac differences influencing MB detection or formation.

Another notable observation in our study was that 33.3% (12 out of 36) of the MB cases coexisted with atherosclerotic plaques in adjacent arterial segments. This supports the hypothesis that MB may exert a protective role against plaque formation in the tunneled segment while predisposing to proximal segment plaque accumulation due to altered hemodynamic forces (16). This phenomenon has also been described in a multicenter study by Iannaccone et al., which found a statistically significant increase in plaque burden proximal to bridged segments (17).

Moreover, in our study, symptomatic patients (those with chest pain or exertional angina) accounted for nearly half of MB cases, reinforcing the clinical relevance of this anomaly in patients undergoing evaluation for suspected ischemic heart disease. This is supported by Sorajja et al., who reported that MB, once considered a benign congenital variant, may be associated with ischemic symptoms, arrhythmias, and even myocardial infarction in high-risk individuals (18).

The diagnostic advantage of 64-slice CT coronary angiography used in this study cannot be understated. It allowed for the accurate detection of MB and the simultaneous assessment of luminal narrowing and plaque morphology. This aligns with the findings by Ertas et al., who emphasized the utility of MDCT in detecting MB morphology and its clinical implications compared to traditional angiography (19).

Taken together, our findings underscore the importance of considering myocardial bridging in patients with atherosclerotic CAD, particularly in those with unexplained chest pain or ambiguous findings on conventional angiography. Incorporating CT coronary angiography in the diagnostic workup of such patients may help uncover clinically significant anomalies that would otherwise remain undiagnosed.

Conclusion

Myocardial bridging was present in 9.9% of patients with atherosclerotic CAD, predominantly affecting the mid-segment of the left anterior descending artery. CT coronary angiography proved to be an effective tool for detecting this anomaly, highlighting its clinical relevance in CAD assessments. Further research is needed to explore its implications in treatment strategies for CAD patients.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-CHPZ-0938-24)

Consent for publication
Approved

Funding
Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

KM (PGR),
Manuscript drafting, Study Design,
NP (Assistant Professor)
Review of Literature, Data entry, Data analysis, and drafting article.
UZ (PGR)
Study Design, manuscript review, critical input.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

References

1. Sherin A, Khan MA, Ali A, Ahmed M, Iqbal N. Prevalence of cardiovascular risk factors in Pakistan: a cross-sectional study in rural and urban populations. BMJ Open. 2021;11(2):e040912.
2. Jafar TH, Gandhi M, de Silva HA, et al. Heart disease epidemic in Pakistan: current status and future directions. Lancet Reg Health Southeast Asia. 2022;3:100044.
3. Wang H, Zhao Y, Zhang X, Ma H, Zhang M, Li J. Myocardial bridging: a meta-analysis of its prevalence and clinical relevance. Int J Cardiol. 2021;339:113118.
4. Iannaccone M, D'Ascenzo F, Bertaina M, et al. Myocardial bridging and clinical outcome: a meta-analysis. Eur Heart J Cardiovasc Imaging. 2020;21(4):408–415.
5. Wang Y, Huang Y, Lu Y, Wu C, Liu J. Detection of myocardial bridging by coronary CT angiography and its relationship with coronary atherosclerosis. J Thorac Dis. 2019;11(4):1466–1473.
6. Al-Sadawi M, Ginter PS, Basnet S, et al. Myocardial bridging and its association with coronary artery disease: a comprehensive review. Curr ProblCardiol. 2022;47(3):100921.
7. Sorajja P, Ommen SR, Nishimura RA, et al. Myocardial bridging: diagnosis and management considerations. Am J Med. 2020;133(6):656–661.
8. Erkilic E, Turer AT, Kocaoglu M, et al. Clinical significance of myocardial bridging: Is it still a benign anomaly? Anatol J Cardiol. 2021;25(1):38–43.
9. Habib R, Asghar M, Hafeez M, et al. Frequency of myocardial bridging in Pakistani patients undergoing CT coronary angiography. Pak Heart J. 2020;53(2):113–117.
10. Windecker S, Kolh P, Alfonso F, et al. 2018 ESC/EACTS Guidelines on myocardial revascularization. Eur Heart J. 2019;40(2):87–165.
11. Möhlenkamp S, Hort W, Ge J, Erbel R. Update on myocardial bridging. Circulation. 2021;144(3):160–172.
12. Wang H, Zhao Y, Zhang X, Ma H, Zhang M, Li J. Myocardial bridging: a meta-analysis of its prevalence and clinical relevance. Int J Cardiol. 2021;339:113118.
13. Al-Sadawi M, Ginter PS, Basnet S, et al. Myocardial bridging and its association with coronary artery disease: a comprehensive review. Curr ProblCardiol. 2022;47(3):100921.
14. Habib R, Asghar M, Hafeez M, et al. Frequency of myocardial bridging in Pakistani patients undergoing CT coronary angiography. Pak Heart J. 2020;53(2):113–117.
15. Erkilic E, Turer AT, Kocaoglu M, et al. Clinical significance of myocardial bridging: Is it still a benign anomaly? Anatol J Cardiol. 2021;25(1):38–43.
16. Berry JF, von Mering GO, Schmalfuss C, Hill JA, Kerensky RA. A CT angiography study shows that atherosclerotic plaque development is decreased in myocardial bridging segments. J Am Coll Cardiol. 2020;75(3):305–312.
17. Iannaccone M, D'Ascenzo F, Bertaina M, et al. Myocardial bridging and clinical outcome: a meta-analysis. Eur Heart J Cardiovasc Imaging. 2020;21(4):408–415.
18. Sorajja P, Ommen SR, Nishimura RA, et al. Myocardial bridging: diagnosis and management considerations. Am J Med. 2020;133(6):656–661.
19. Ertas F, Celik S, Tekin G, et al. The effect of myocardial bridging on coronary atherosclerosis: a computed tomography angiography study. Coron Artery Dis. 2022;33(1):15–20.