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Myocardial Bridging, Unusual Cause of Myocardial Infarction; Case Report and Review of Literature

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ABSTRACT

Myocardial bridging is a common coronary anomaly. Although it is considered to be a benign condition, it can rarely be complicated by myocardial infarction. Clinicians should be suspicious of myocardial bridging as an etiology of myocardial infarction when other more common etiologies have been excluded. High resolution CT angiography is the gold standard for diagnostic evaluation, with the length and depth of the bridge, and response to conservative therapies guiding clinical decision making on surgical correction.

Myocardial bridging is a congenital coronary anomaly in which the coronary arteries pass through the heart muscle rather than lying on its surface. It is typically a benign condition, and most patients are asymptomatic. However, some may experience symptoms of angina. In rare cases, patients can present with myocardial ischemia or infarction. In this report, we present the case of a 38-year-old female who presented with a 2-month history of chest pain. Further evaluation with coronary computed tomography angiography (CCTA) revealed myocardial bridging. Subsequently, she developed a myocardial infarction, a rare complication of this condition. We discuss this uncommon complication of a common anomaly.

1 | Introduction

Myocardial bridging (MB) is a benign congenital coronary anomaly in which a segment of a coronary artery travels within the heart muscle rather than resting on its surface. The exact prevalence of MB is uncertain; however, it is estimated to occur in approximately 5% to 8% of the population, based on various imaging studies. Despite being relatively common, it is frequently underdiagnosed due to subtle symptoms that are often misattributed to other cardiac conditions. Moreover, MB may not always be detected through standard diagnostic tests like routine angiography [1, 2].

While many individuals remain asymptomatic, some may experience symptoms such as chest pain during physical activity or emotional stress, along with other angina-like manifestations, including shortness of breath, palpitations, and dizziness [3, 4].

Classifying myocardial bridging (MB) into superficial (1–2 mm of myocardium) and deep (> 2 mm) bridges is crucial, as the depth of the bridge significantly affects the degree of coronary artery compression during systole [1]. This compression can lead to various complications, including angina, arrhythmias, impaired left ventricular function, myocardial stunning, early mortality following cardiac transplantation, and, in severe cases, even sudden death [2].

In women, especially younger ones, heart disease often presents with unique symptoms due to anatomical differences and hormonal influences, particularly estrogen. Women generally have smaller coronary arteries and exhibit distinct hemodynamic responses, which can lead to atypical cardiac manifestations. While estrogen supports cardiovascular health, fluctuations during critical life stages, particularly menopause and post-menopause, can elevate the risk of ischemia and other complications. This highlights the urgent need for healthcare professionals to recognize the specific characteristics of heart disease in women and to adopt tailored diagnostic approaches for timely and accurate evaluations, ultimately improving outcomes for this population [5, 6].

MB induces myocardial ischemia through various mechanisms, including supply–demand mismatch, endothelial dysfunction, coronary microvascular dysfunction, and external mechanical compression [7].

2 | Case History / Examination

In July 2023, a 38-year-old female patient presented to our cardiac outpatient department (OPD) with a 2-month history of chest pain, having visited multiple hospitals for this complaint. The pain was intermittent, retrosternal, and squeezing in nature, radiating to the left arm and jaw. It was also associated with diaphoresis and worsened with exertion. She had repeatedly visited a nearby hospital, where she underwent evaluation with an electrocardiogram (ECG) and troponin tests, both of which were normal. She was prescribed nitrates, but experienced no relief. Upon further inquiry, she mentioned a history of migraines, which occurs two times per month, for which she takes diclofenac 50 mg per oral as needed. Otherwise, she had no chronic medical conditions or comorbidities and denied any substance use. She also reported no family history of cardiac disease or sudden cardiac death.

Upon physical examination, she appeared healthy, with normal vital signs and an unremarkable physical exam.

3 | Differential Diagnosis, Investigations and Treatment

During this initial visit to our hospital, she was re-evaluated with an ECG (Figure 1) and troponin, both of which were normal. In addition, the echocardiogram (Echo), chest X-ray (CXR), and thyroid function test (TFT) were also normal. After a cardiology consultation, a week later, the patient underwent coronary computed tomography angiography (CCTA). The CCTA revealed a short segment (8 mm) of an intramyocardial course of the distal left anterior descending artery (LAD), confirming the diagnosis of myocardial bridging (Figure 2A–D).

After the diagnosis of myocardial bridging was confirmed, the patient was counseled on treatment options and started on Metoprolol 25 mg orally once daily. Subsequently, the dose of metoprolol was increased to 25 mg orally twice daily, and amlodipine 10 mg orally once daily was added, as non-dihydropyridine calcium channel blockers were not available in our setting.

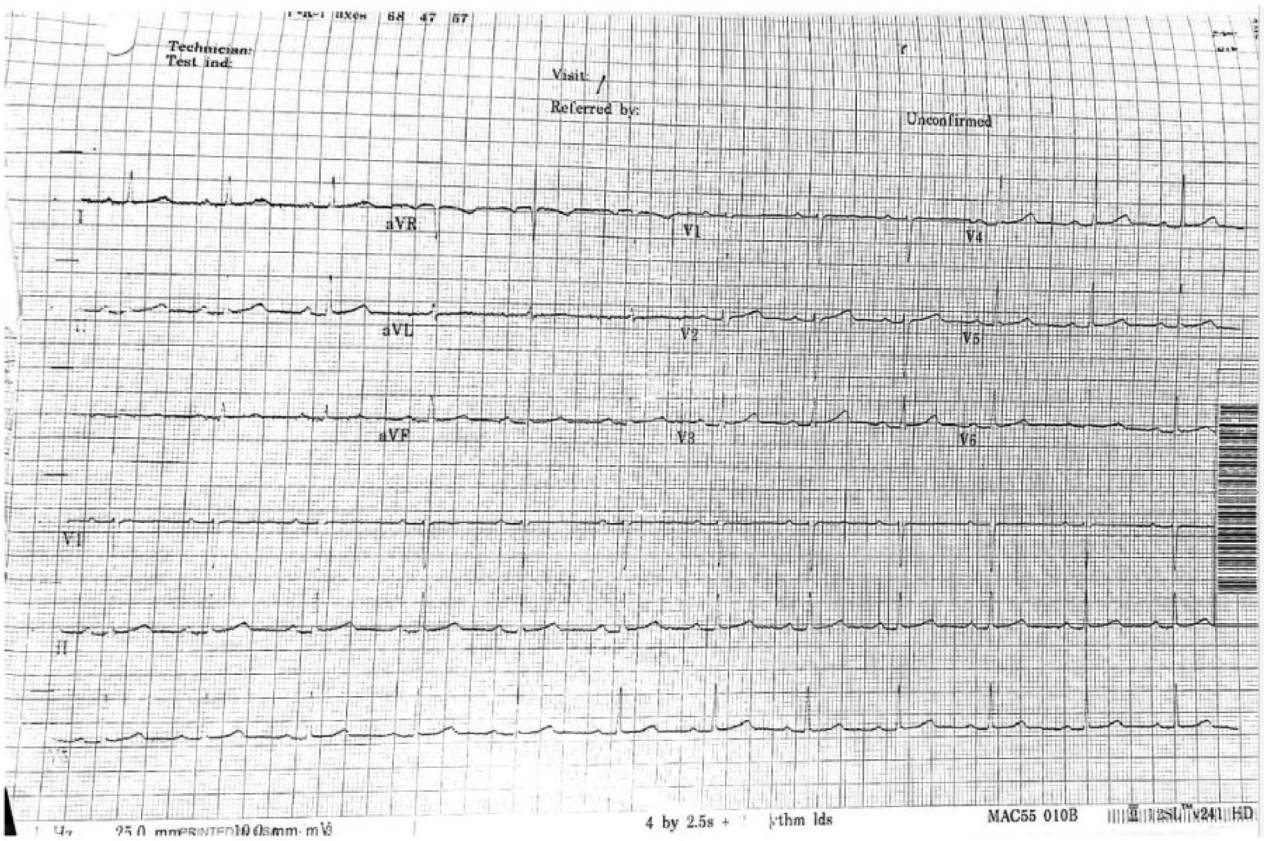

FIGURE 1 | ECG image showing normal sinus rhythm with no ST/T wave changes.

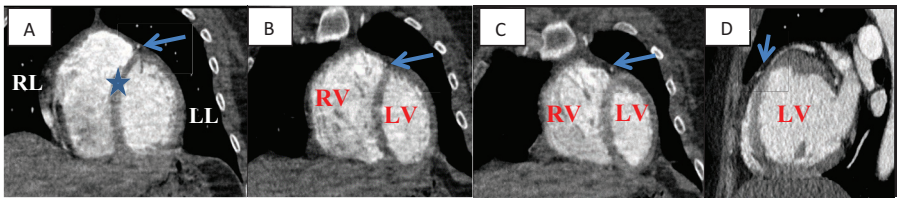

FIGURE 2 | (A–D): Subsequent coronal coronary CT angiography images from A to C (posterior to anterior), the arrows showing left anterior descending artery course. There is intramyocardial course with luminal narrowing of mid LAD on the image B. Normally LAD courses anterior to interventricular septum (star in A) in interventricular groove. The intramyocardial course of mid LAD is also seen on sagittal image (arrows on image D). (LV, left ventricle; RV, right ventricle; LL, left lung; RL, right lung).

4 | Outcome and Follow-Up

Despite this medical management, the patient continued to experience persistent chest pain. During follow-up, after 4 months of initial presentation to our hospital, she developed a non-ST-segment elevation myocardial infarction (NSTEMI), as evidenced by elevated troponin levels of 179 and 156 (4475 and 3900 times the upper limit of the normal range) with a normal ECG. She was counseled regarding revascularization therapy.

5 | Discussion

The normal course of coronary arteries lies between the pericardium and epicardium, the two outermost layers of the heart. However, when a portion of the epicardium is encased by myocardial fibers, it is referred to as a myocardial bridge. This condition can occur in any coronary artery, but the most commonly involved is the left anterior descending artery (LAD), while the least commonly affected are the left circumflex and right coronary arteries [1, 8].

Myocardial bridging was previously considered a benign cardiovascular anomaly. However, due to increasing evidence of its complications, it is no longer viewed as benign, at least in a subset of patients. While it is typically benign and most patients are asymptomatic, some may experience complications such as stable or unstable angina, vasospastic angina, acute coronary syndromes, AV blocks, arrhythmias, and sudden cardiac death [9–12].

It is not uncommon for the diagnosis of MB to be delayed. This may be due to its varied clinical presentations and the lack of advanced imaging modalities in resource-limited settings. Our patient visited several health facilities before being referred to our hospital, where the diagnosis was finally made. This delay could be attributed to a lack of awareness about MB and the unavailability of advanced imaging techniques.

MB can induce acute coronary syndromes through several mechanisms, including coronary spasm, thrombosis, coronary dissection, or the development of focal atherosclerosis proximal to the bridged segment [13].

The diagnosis of MB can differ significantly depending on the imaging modality used to identify these variants.

Multiple invasive and non-invasive techniques have been utilized to diagnose MB, with variability in the diagnostic accuracy of each method. Invasive coronary angiography (CAG) was traditionally considered the gold standard for diagnosing MB. However, recent evidence suggests that CCTA provides an accurate depiction of the distribution and length of myocardial bridges, showing strong agreement with CAG diagnoses [14, 15].

The advantage of CCTA lies in its high spatial resolution and its ability to visualize not only the coronary artery lumen but also the surrounding structures in three dimensions. This enables accurate assessment of the vessel wall, the surrounding myocardium, and the lumen [1, 16]. Currently, CCTA is considered the gold standard for diagnosing myocardial bridging. Our patient was examined using CCTA, which confirmed the diagnosis.

Currently, there are no universal guidelines for the treatment of MB. However, most experts agree that the first-line treatment for symptomatic MB typically involves medications such as beta-blockers or non-dihydropyridine calcium channel blockers. Nitrates should be avoided, as they may worsen symptoms. Surgical intervention is considered for patients who do not respond to medical therapy, especially when the bridge is longer than 20 mm (2 cm) and symptoms are refractory to pharmacologic management. Procedures such as myotomy, intracoronary stenting and coronary artery bypass graft surgery have been employed for persistent symptoms, though the long-term prognosis remains uncertain [17, 18]. Coronary artery bypass grafting or supra-arterial myotomy, also known as “unroofing,” is the most common surgical option for MB. Studies have shown that the blunt dissection technique of MB unroofing is a safe and effective method that reduces surgical time, ventilator time, and hospital stay [19, 20].

Stent placement is another treatment option. A recent study evaluating the use of drug-eluting stents (DES) in patients with medically refractory angina due to MB suggests that DES implantation can be an effective treatment option for these patients [21].

Our patient was treated with beta-blockers and calcium channel blockers without symptomatic relief, and she was subsequently counseled on surgical intervention options.

6 | Conclusion

In conclusion, myocardial bridging is a common coronary anomaly that is not always benign, as it can rarely lead to complications such as myocardial infarction. Our case emphasizes the importance of considering myocardial bridging in young patients presenting with angina, particularly when there are no other obvious risk factors.

Author Contributions

Merga Daba: conceptualization, writing – original draft, writing – review an editing. **Dawit Bineyam:** writing – original draft, investigations. **Ibraist Yohannes:** writing – original draft, writing – review and editing. **Beniam Yohannes:** writing – original draft and investigation. **Rabirra Waktola:** investigation and writing – review and editing. **Eshetu Bedada:** supervision and validation.

Disclosure

The authors have nothing to report.

Ethics Statement

The author's institution does not require ethical approval for the publication of single case report.

Consent

The patient has provided written informed consent for publication of the case.

Data Availability Statement

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

Data Sharing Statement

Patient's history, physical findings, laboratory investigations, and imaging findings used to support the finding of this study is included in the article.

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