J Nepal Health Res Counc 2022 Jul-Sep; 20 (56): 774-8

Prevalence of Myocardial Bridging in Angiography Study

Smriti Shakya,[1] Ratna Mani Gajurel,[1] Chandra Mani Poudel,[1] Hemant Shrestha,[1] Surya Devkota,[1] Sanjeev Thapa,[1] Bhawani Manandhar,[1] Rajaram Khanal[1]

[1]Department of Cardiology, Manmohan Cardiothoracic Vascular and Transplant Center (MCVTC), Institute of Medicine, TUTH, Kathmandu, Nepal.

ABSTRACT

Background: Myocardial bridging is a congenital anomaly in which a segment of epicardial coronary artery takes an intramyocardial course, the systolic compression of which could be asymptomatic or may lead to major hemodynamic changes such as myocardial ischemia, arrhythmias or sudden cardiac death. The prevalence is highly variable depending upon different investigational modalities to diagnose it. Here we have aimed to study the prevalence through invasive coronary angiography.

Methods: This retrospective study was carried out at Manmohan Cardiothoracic Vascular and Transplant center, Kathmandu, Nepal. The invasive coronary angiography of 5096 patients were studied from March 2018 to April 2021 done for various indications.

Results: Among all the patients, the myocardial bridging was identified in 257 (5.04%) patients. About 177 (68.9%) were males and 80 (31.1%) were females. The mean age of the patients having myocardial bridging was 54.52 ± 10.31years. Diabetes mellitus was found in 33(12.8%) and hypertension was found in 77(29.9%) patients with myocardial bridging. Stable angina (29.2%) was the most common clinical presentation. Treadmill test was positive in about 70 (27.2%) patients. Majority of patients had myocardial bridge in left anterior descending artery alone (89.9%) and located mostly in mid-part (74.9%).

Conclusions: The myocardial bridging is not an uncommon finding on invasive coronary angiography in middle aged people who present with typical angina.

Keywords: Coronary angiography; myocardial bridging; prevalence.

INTRODUCTION

Myocardial bridging (MB) is a congenital anomaly of epicardial coronary artery where a segment of it gets tunneled under overlying myocardium.[1] This causes vessel compression of the involved segment during systole that is visualized angiographically as the "milking effect".[2] The prevalence is highly variable ranging from 1.5 to 16% when assessed by invasive coronary angiography but autopsy report depicts more than 80%.[3] The prevalence may range from 15% to 50% when assessed by computed tomography coronary angiogram (CTCA).[4] Initially thought to be benign and mostly asymptomatic, cases of complications have been noted from myocardial ischemia, infarction, arrhythmias, heart blocks, ventricular dysfunction to sudden cardiac death.[5-8] It is commonly present in the left anterior descending artery mostly in the middle segment, however it may also be seen in other coronary arteries such as diagonal and obtuse marginal branches. [9-12]

Since there are limited study on this regard done in Nepalese literature, this study aims to assess the clinical profile and prevalence of myocardial bridging in patients undergoing coronary angiography in a tertiary care center of Nepal.

Correspondence: Smriti Shakya, Department of Cardiology, Manmohan Cardiothoracic Vascular and Transplant Center (MCVTC), Institute of Medicine, TUTH, Kathmandu, Nepal. Email: drsmritishakya@gmail.com.

METHODS

This study included 5096 patients who underwent coronary angiography from March 2018 to April 2021at Manmohan Cardiothoracic Vascular and Transplant Center, Kathmandu. This is a descriptive cross sectional study. This study was started after the ethical approval from the Institutional Review Committee of the Institute of Medicine (Ref. 670(6-11)E2 077/078). All the patients who underwent coronary angiography for various indications during the study period were included. The sampling method used was non probability convenient sampling. Baseline characteristics were noted. Continuous variables were expressed as mean± SD and dichotomous variables were expressed in numbers and percentages. All analyses were conducted using SPSS 21 software.

The invasive coronary angiograms were evaluated for the presence of myocardial bridging visually which is defined as systolic compression of the epicardial coronary artery that releases during diastole. All the patients with the presence of myocardial bridging were included in this study. The coronary arteries which had myocardial bridging were also noted. The hospital records were then retrieved retrospectively regarding the demographic profile such as age, gender and the clinical presentation for which invasive coronary angiography was done such as stable angina, unstable angina, myocardial infarction, atypical chest pain, arrhythmias or preoperative assessment of coronary arteries. The data were then collected and analysed.

RESULTS

A total of 5096 patients underwent coronary angiography for various indications during the study period. Among all the patients who underwent coronary angiography, the myocardial bridging was identified in 257 (5.04%) patients. Out of the patients with myocardial bridging, 177 (68.9%) were males and 80 (31.1%) were females. The mean age of the patients having myocardial bridging was 54.52 ± 10.31years, ranging from 25 years to 83 years. Among all the patients having myocardial bridging, diabetes mellitus was found in 33(12.8%) and hypertension was found in 77(29.9%) patients. The baseline characteristics of the patients with myocardial bridging is given in (Table 1).

The various indications for patients with myocardial bridging undergoing coronary angiography is shown in (Table 2). The most common presentation seen was stable angina (29.2%) followed by atypical chest pain (23.3%) and unstable angina (15.2%). About 24 (9.3%) patients underwent coronary angiography as preoperative assessment for conditions which included degenerative aortic stenosis (5), bicuspid aortic valve with aortic regurgitation (1), ascending aortic aneurysm (1), pre renal transplant assessment (1), left atrial myxoma(2), atrial septal defect(2), rheumatic heart disease (mitral stenosis with mitral regurgitation (9) and mitral stenosis with mitral regurgitation with aortic regurgitation (3)). The treadmill test was positive in about 70 patients (27.2%) who presented with stable angina or atypical chest pain. The ventricular arrhythmia included ventricular premature complexes or ventricular tachycardia.

Table 1. Baseline characteristics of patients with myocardial bridging.

Patient characteristics	Number(%)
Age (years)	Mean: 54.52±10.31
Gender	
Male	177(68.9%)
Female	80(31.1%)
Hypertension	77(29.9%)
Diabetes Mellitus	33(12.8%)

Table 2. Presenting diagnosis of patients with myocardial bridging undergoing coronary angiography.

Diagnosis	Number(%)
Stable angina	75(29.2%)
Atypical chest pain	60(23.3%)
Unstable Angina	39(15.2%)
NSTEMI	16(6.2%)
STEMI	12(4.7%)
Ventricular Arrhythmia	10(3.9%)
STEMI late presentation	9(3.5%)
DCM	7(2.7%)
HOCM	5(2%)
Preoperative CAG	24(9.3%)
Total	**257(100%)**

Majority of the patients had MB in left anterior descending (LAD) artery alone (89.9%) and located mostly in mid-LAD 173 (74.9%) followed by distal LAD 52 (22.5%) and proximal LAD 6 (2.6%)(Figure 1).Majority had right dominant coronary system (Table 3).

Among all the patients, 70 (27.2%) patients had coronary artery disease, which included 36 (51.4%) single vessel

disease (SVD), 17 (24.3%) double vessel disease(DVD), 16 (22.9%)triple vessel disease (TVD) and 1 (1.4%) TVD with left main disease. However, the atherosclerosis wasn't seen in the myocardial bridging segment.

Table 3. Coronary arteries with myocardial bridging.

Involved artery	No. of patients (%)
LAD	231(89.9)
D1	4(1.5)
Septal artery	3(1.2)
LCX	7(2.7)
OM	8(3.1)
RI	1(0.4)
RCA	3(1.2)
Total	**257(100)**
Dominance	**No. of patients (%)**
Right	207(80.5)
Left	29(11.3)
Co-dominance	21(8.2)
Total	**257(100)**

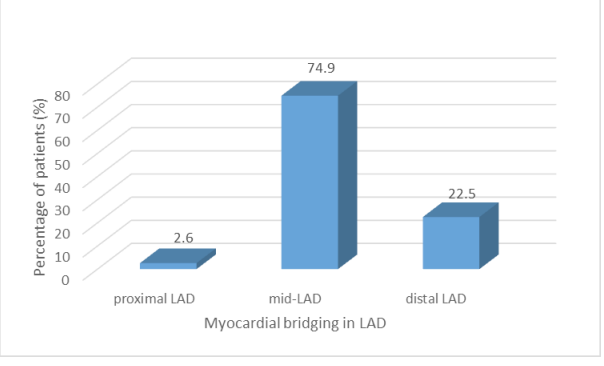

Figure 1. Distribution of Myocardial Bridging in different parts of LAD.

DISCUSSION

Myocardial bridging is frequently encountered during coronary angiography as an incidental finding. However, studies suggest that it may be associated with symptoms of myocardial ischemia and lead to complications such as ventricular arrhythmia and even sudden cardiac death.

The prevalence of myocardial bridging varies widely from 0.5 to 16% with invasive coronary angiography. In our study, the prevalence was 5.04% and this value is similar to some studies done in India.[13] In a study done by Wirianta et al, the prevalence was shown relatively high in most studies that used computed tomography coronary angiography (CTCA) to detect myocardial bridging that lies between 15% to 50%.[4] However, the mean age of the presenting patients and the male preponderance seen in our study were similar to these studies.[4,13]

The diabetes mellitus and systemic hypertension found in the patients with myocardial bridging were similar to other studies.[13] The most common presentation of patients who had myocardial bridging in our study was stable angina. The patients who had positive treadmill stress test (TMT) was 27.2% who had symptoms of stable typical angina or atypical chest pain, which is alike few other studies nonetheless, there are limited data about the association between non-invasive stress test and finding of myocardial bridging.[4,14] Although the coronary blood flow occurs predominantly during diastolic phase of the cardiac cycle, the myocardial ischemia caused by the systolic phenomenon of myocardial bridging has been explained by few previous studies. They deciphered that there is a time-lag of up to one third of diastole before blood flow returns to normal following systolic compression, which means that there is a delay in diastolic relaxation of the coronary artery which causes the symptoms and signs of myocardial ischemia and it becomes the limiting factor for myocardial perfusion specially during tachycardia and maximal coronary vasodilation.[15,16] Many patients were noted to have systemic hypertension as a coexisting comorbidity, some had hypertrophic cardiomyopathy and aortic stenosis who had myocardial bridging. The progressive increase in left ventricular wall tension probably explains the reason that though the myocardial bridging is present since birth, it produces the symptoms only in later part of life.[17-19] In our study, some cases were found during assessment of coronary arteries as part of preoperative workup of conditions such as aortic stenosis and rheumatic heart disease, and also for ventricular arrhythmia or ST-T changes as in case of hypertrophic cardiomyopathy. However, there are studies that also show the symptoms ranging from angina pectoris and myocardial infarction to ventricular tachycardia and sudden death which are associated with myocardial bridge.[17,20,21]

We found majority of myocardial bridging in left anterior descending (LAD) coronary artery (89.9%), mainly mid-LAD (74.9%). Mavi et al also found LAD as the main involved artery (96.5%) and the middle third of LAD as the most common site of myocardial bridging (78.5%), as

was seen in several other similar studies.[13,22] We found few cases involving proximal LAD and distal LAD and there were few cases where myocardial bridging was seen in other coronary vessels such as LCX, OM and RCA.

In our study, only 27.2% patients had coronary artery disease among all patients with myocardial bridging, among whom 51.4% had single vessel disease, 24.3% had double vessel disease, 22.9% had triple vessel disease and 1.4% had TVD with left main disease. There was no atherosclerotic plaque angiographically seen within the myocardial bridge segment which was a similar finding in other studies as well.[13,23] There are data that myocardial bridging is associated with decreased development of atherosclerosis under and proximal to the bridged segment.[24]

There were few limitations in the study. The causal association between symptoms and myocardial bridging of the coronary artery couldn't be analyzed as the follow up data following the medical management of those patients weren't available as this was a retrospective study. Furthermore, the mean diameter of systolic compression of bridged segment and depth of bridges couldn't be assessed in this study paving the path for further studies on this regard with newer diagnostic modalities in the future.

CONCLUSIONS

This study shows that myocardial bridging is one of the common finding we encounter in middle aged people who present with stable angina as well as with atypical chest pain. However, the attributable causal association of the ischemic symptoms with the myocardial bridging need further studies.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. Angelni P, Velasco JA, Flamm S. Coronary anomalies: incidence, pathophysiology, and clinical relevance. Circulation. 2002; 105:2449-2454.[Article]

2. Portmann WC, Iwig J. The intramural coronary artery on the angiogram. FortschrRontgenstr. 1960; 92:129-132. [Article]

3. Rossi L, Dander B, Nidasio GP, Arbustini E, Paris B, Vassanelli C et al. Myocardial bridges and ischemic heart disease. Eur Heart J. 1980;1: 239-245.[Article]

4. Wirianta J, Mouden M, Ottervanger JP, Timmer JR, Juwana YB, de Boer MJ, et al. Prevalence and predictors of bridging of coronary arteries in a large Indonesian population, as detected by 64-slice computed tomography scan. Netherlands Heart Journal. 2012 Oct;20(10):396-401. [Article]

5. Feld H, Guadanino V, Hollander G, Greengart A, Lichstein E, Shani J. Exercise-induced ventricular tachycardia in association with a myocardial bridge. Chest.1991;99:1295-1296.[Article]

6. Chee TP, Jensen DP, Padnick MB, Cornell WP, Desser KB. Myocardial bridging of the left anterior descending coronary artery resulting in subendocardial infarction. Arch Intern Med. 1981;141: 1703-1704.[Article]

7. den Dulk K, Brugada P, Braat S, Heddle B, Wellens HJ. Myocardial bridging as a cause of paroxysmal atrioventricular block. J Am CollCardiol. 1983;1: 965-969.[Article]

8. Bestetti RB, Costa RS, Kazava DK, Oliveira JS. Can isolated myocardial bridging of the left anterior descending coronary artery be associated with sudden death during exercise? ActaCardiol. 1991;46: 27-30. [Article]

9. Irvin RG. The angiographic prevalence of myocardial bridging in man. Chest. 1982;81(2):198-202.[Article]

10. Jacobs JE, Bod J, Kim DC, Hecht EM, Srichai MB. Myocardial bridging: evaluation using single-and dual-source multidetector cardiac computed tomographic angiography. J Comput Assist Tomogr. 2008;32 (2):242-6.[Article]

11. Sheu M-H, Chen Y-D, Kuo Y-S, Wu M-H, Chen C-K, Chang C-Y. Myocardial bridging in Taiwanese: noninvasive assessment by 64-detector row coronary computed tomographic angiography. J Chin Med Assoc. 2011;74(4):164-8.[Article]

12. Stefan Möhlenkamp, WaldemarHort, JunboGe, RaimundErbel. Update on myocardial Bridging. Circulation. 2002; 106(20): 2616-2622.[Article]

13. Sunil K. Karna, MahendraChourasiya, Rohan P. Parikh, TanviChaudhari, Utsav Patel. Prevalence of myocardial bridge in angiographic population-A study from rural part of western India. Journal of Family Medicine and

Primary Care. 2020; 9(4): 1963-1966.[Article]

14. Bourassa MG, Butnaru A, Lespérance J. Symptomatic myocardial bridges: overview of ischemic mechanisms and current diagnostic and treatment strategies. J Am CollCardiol. 2003; 41:351-9.[Article]

15. F. Navarro-Lopez, J. Soler, J. Magrina. Systolic compression of coronary artery in hypertrophic cardiomyopathy. Int J Cardiol. 1986; 12(3):309-320.[Article]

16. J.R. Rouleau, L. Roy, J.G. Dumesnil, G.R. Dagenais. Coronary vasodilator reserve impairment distal to systolic coronary artery compression in dogs. Cardiovascular Research. 1983; 17(2): 96-105.[Article]

17. Noble J, Bourassa MG, Petitclerc R, Dyrda Y. Myocardial bridging and milking effect of the left anterior descending coronary artery: normal variant or obstruction? Am J Cardiol. 1976;37:993-9.[Article]

18. Morales AR, Romanelli R, Boucek RJ. The mural left anterior descending coronary artery, strenuous exercise and sudden death. Circulation.1980;62:230-7.[Article]

19. Kitazume H, Kramer JR, Krauthamer D, El Tobgi S, Proudfit WL, Sones FM. Myocardial bridges in obstructive hypertrophic cardiomyopathy. Am Heart J. 1983;106:131-5.[Article]

20. Soran O, Pamir G, Erol C, Kocakavak C, Sabah I. The incidence and significance of myocardial bridge in a prospectively defined population of patients undergoing coronary angiography for chest pain. Tokai J ExpClin Med. 2000;25:57-60.[Download PDF]

21. Morales AR, Romanelli R, Tate LG, Boucek RJ, de Marchena E. Intramural left anterior descending coronary artery: significance of the depth of the muscular tunnel. Hum Pathol.1993;24:693-701.[Article]

22. Mavi A, Sercelik A, Ayalp R, Karben Z, Batyraliev T, Gumusburun E. The angiographic aspects of myocardial bridges in Turkish patients who have undergone coronary angiogram. Ann Acad Med Singapore. 2008; 37:49-53. [Download PDf]

23. Möhlenkamp S, Hort W, Ge J, Erbel R. Update on myocardial bridging. Circulation. 2002;106: 2616-22. [Article]

24. Masuda T, Ishikawa Y, Akasaka Y. The effect of myocardial bridging of the coronary artery on vasoactive agents and atherosclerosis localization. J Pathol. 2001;193: 408-14. [Article]