

# Proportion of Myocardial Bridge in a Tertiary Care Hospital of North India: A Retrospective Observational Study

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## ABSTRACT

**Introduction:** Myocardial bridging, a congenital coronary anomaly, is a condition in which a segment of a major epicardial coronary artery runs intramurally through the myocardium. During systole, the coronary artery is compressed and can cause angina, arrhythmia, depressed left ventricular function, myocardial stunning and sudden death.

**Aim:** To find the proportion of Myocardial Bridge (MB) in patients admitted for cardiac evaluation in a tertiary care hospital of north India.

**Materials and Methods:** A retrospective, observational study was performed in the Cardiac Care Unit of the Adesh institute of Medical Sciences and Research Bathinda from January 2017 to December 2020. A total of 3800 adult patients of both sexes, who underwent diagnostic coronary angiography were evaluated for MB between January 2017 to December 2020. The data was collected from the patients and statistically analysed on 15th April 2021.

**Results:** The proportion of MB was 208 (5.50%), in which 74.51% were males and 25.49% were females. Dominance-wise, 72.11% were right dominant, 22.60% were left dominant and 5.29% had balanced circulation. The incidence of myocardial bridging was 3.95% in right dominant, 1.24% in left dominant and 0.28% in balanced dominant patients. Total 199 (95.67%) MB were located on the Left Anterior Descending Artery (LAD) of which mid LAD were in 186 (89.42%), distal LAD in 9 (4.45%), proximal LAD in 4 (1.95%) and on diagonal (D1) it was 9 (4.45%). Double bridge was observed in 6 (2.89%) cases in proximal and distal regions of LAD.

**Conclusion:** Clinical suspicion of a MB should be considered in young patients with typical or atypical chest pain, where the probability of atherosclerosis is low and where there are no other cardiovascular risk factors. There was higher incidence of MB in proximal distal segments of LAD and diagonal arteries.

**Keywords:** Angiogram, Congenital coronary anomalies, Left anterior descending artery

## INTRODUCTION

Coronary arteries are normally epicardial in position. In some patients a segment of coronary artery is crossed by few cardiac muscle fibers. This pattern of arrangement of cardiac muscle fibers over a segment of coronary artery is known as Myocardial Bridge (MB), which is a congenital anomaly. The segment of coronary artery that has intramural course is known as tunneled artery or intramural. This was first seen in autopsy by Reyman HC in 1737 [1]. First MB was reported by Geiringer E in 1951 during anatomical dissection [2]. The systolic compression of epicardial coronary artery by the MB was first seen on coronary angiography by Portmann WC and Iwig I in 1960 [3]. The incidence of MB on angiographic studies range from 0.5-8.5% [4-6]. During autopsy the incidence ranges from 5.5-90% [7-13]. Many authors stated that MB may be protective on the coronary artery at the site of bridge [14,15]. Although MB is asymptomatic in many patients, its association with myocardial ischaemia, stunting, heart failure, myocardial infarction and sudden cardiac death had been reported [16,17].

The MB are generally located on the middle segment of Left Anterior Descending artery (LAD) involving different lengths of the coronary arteries and varying depths of myocardial wall [18]. The coronary angiography shows systolic compression of epicardial coronary artery at site of MB and leads to coronary obstruction. The typical angiographic finding in myocardial bridging is systolic narrowing of an epicardial artery [18].

The percentage of coronary obstruction depends on various factors such as length of MB, thickness of MB and degree of cardiac contractility [19,20]. Previously thought to be benign and asymptomatic condition, but recently found to be associated with angina, myocardial ischaemia, acute coronary syndrome, left ventricular dysfunction/stunning, supraventricular and ventricular arrhythmias, ventricular septal rupture and sudden cardiac death [21-26]. The present study

was carried out to find out the proportion of MB in patients admitted for cardiac evaluation in a tertiary care centre of North India.

## MATERIALS AND METHODS

After approval of Institutional Ethics Committee wide letter number-(AU/EC/FM/2021/134), this retrospective, observational study was conducted in the Cardiac Care Unit, of the Adesh institute of Medical Sciences and Research Bathinda from January 2017 to December 2020. As per hospital protocol these patients were taken up for intervention, while the selection criteria for the study depended upon the data that was available (being retrospective). The data was analysed on 15<sup>th</sup> April 2021.

**Inclusion and Exclusion criteria:** A total of 3800 adult patients of both sexes who underwent diagnostic conventional coronary angiography were included in the study. Patients with total occlusion bypass surgery and artifacts were excluded from the study.

Coronary artery disease and presence of MB were recorded. As per hospital protocol, MB was identified based on narrowing of coronary artery in systolic phase resulting in at least 50% reduction of luminal diameter in comparison with the diastolic phase. The diameter of vessel was measured during in end-systolic and end-diastolic phases with an electronic caliper after magnification. All the measurements were recorded in the left anterior oblique position.

## STATISTICAL ANALYSIS

The relevant data was collected from the available record of patients. The data was qualitatively analysed and expressed as frequency distribution of percentages.

## RESULTS

Total of 3800 patients, who went for coronary evaluation, were included in the study. Nineteen patients were excluded due to total

occlusion (7), bypass surgery (8) or artifacts (4). Of all patients, 2712 (71.37%) were males and 1088 (28.63%) were females. Total 82.26% patients had normal coronary arteries, single vessel disease, 2.53% double vessel disease and 1.78% had triple vessel disease.

There were a total of 208 MBs (5.50%) of which 155 were males and 53 were females. Among all the MB patients, 199 (95.67%) were located LAD of which 186 (89.42%) were in mid LAD, 9 (4.45%) on distal LAD, 4 (1.95%) on proximal LAD and 9 (4.45%) were on diagonal (D1). In 6 (2.89%) patients, double bridges in proximal and distal parts of LAD was observed. Total 185 (88.95%) patients with MB had right, 20 (9.61%) left and 3 (1.44%) had balanced dominance [Table/Fig-1].

Dominance	Right n (%)		Left n (%)		Balanced (%)		Total %
Sex	Male	Female	Male	Female	Male	Female	
Bridge							
Present	158 (2.89)	27 (1.06)	12 (0.93)	8 (0.31)	2 (0.26)	1 (0.02)	208 (5.50)
Absent	2295 (60.40)	985 (25.93)	241 (6.34)	42 (1.10)	21 (0.55)	8 (0.21)	3592 (94.50)
Total	2405 (63.29)	1025 (26.99)	276 (7.27)	54 (1.41)	31 (0.81)	9 (0.23)	3781 (100)
Diagnosis							
Normal	2102 (55.31)	800 (21.01)	175 (4.50)	40 (1.05)	10 (0.26)	9 (0.23)	3126 (82.26)
SVD	260 (6.84)	148 (3.89)	76 (2.0)	8 (0.2)	10 (0.26)	0	502 (13.21)
DVD	22 (0.57)	50 (1.31)	22 (0.56)	4 (0.1)	6 (0.15)	0	104 (2.53)
TVD	31 (0.81)	27 (0.71)	3 (0.08)	2 (0.05)	5 (0.13)	0	68 (1.78)
Vessel							
LAD							
Middle	148 (71.15)	20 (9.61)	9 (4.33)	6 (2.88)	2 (0.96)	1 (0.48)	186 (89.42)
Distal	4 (1.92)	4 (1.92)	1 (0.48)	0	0	0	9 (4.33)
Proximal	2 (0.96)	2 (0.96)	0	0	0	0	4 (1.92)
Diagonal	4 (1.92)	1 (0.48)	2 (0.96)	2 (0.96)	0	0	9 (4.33)
Surgical treatment	None						
Stenting	None						

**[Table/Fig-1]:** Patient characteristics and diagnosis.

SVD: Single vessel disease; DVD: Double vessel disease; TVD: Triple vessel disease; LAD: Left anterior descending

Twenty-two (10.57%) patients presented with chest pain, 25 (12.01%) with dyspnoea on exertion and 161 (77.42%) with atypical chest pain. The male patients with MB were of age between 36-55 years and female patient's age between 42-58 years [Table/Fig-2].

Variables	Male	Female	Total N (%)
Age (years) mean±SD	44±10.6	46±10.1	
Symptoms N (%)			
Chest pain	15 (7.21)	7 (3.36)	22 (10.57)
Dyspnoea on exertion	20 (9.61)	5 (2.40)	25 (12.01)
Atypical chest pain	120 (57.70)	41 (19.72)	161 (77.42)
Total	155 (74.52)	53 (25.48)	208

**[Table/Fig-2]:** Age and symptoms of patients with Myocardial Bridge (MB).

## DISCUSSION

The MB is a common finding during routine coronary angiogram. Few previous studies had revealed the cardio protective role of MB, while others showed no protective role of MB. The incidence of MB is found to be greater at autopsy studies than conventional angiographic evaluation [7-13].

Although this malformation is present at birth, symptoms usually develop after the third decade; the reason for which is not clear [15]. The thickness, length of bridge and arrangement of cardiac muscle fibers over the artery affects the appearance of MB on coronary angiography [17]. Use of quality cineangiographic equipment and best techniques with particular attention devoted to examining the phasic changes of coronary diameter might allow a higher number of MB to be identified [17].

The MBs were considered to be a benign condition, but recently these have been associated with serious clinical complications like ischaemia and acute coronary syndromes [19], coronary spasm [20], ventricular septal rupture [21], arrhythmias [22], exercise-induced atrioventricular conduction blocks [23], transient ventricular dysfunction [24] and sudden death [25]. The prognosis of patients with MB, therefore, is not as benign as it was believed to be in the past. In the present study, most of the patients presented with atypical chest pain (77.42%) followed by dyspnoea on exertion (12.01%) and chest pain (10.57%).

Myocardial bridging is generally confined to the mid segment of LAD artery [26]; it is less frequently located in the circumflex artery and is occasionally seen in the right coronary artery. The most commonly involved vessel is left anterior descending artery (middle segment) followed by the left circumflex and the right coronary artery [18,26,27]. The present study found maximum number of MB in mid LAD followed by distal and proximal and diagonal region. Nine patients had MB in mid diagonal (D1). Six patients had double bridges in proximal and distal LAD. The patients with MB were of relatively younger age group. Mid-LAD was predominantly the site for MB in the present study which is similar to the study by Mavi A et al., but in contrast to Cay S et al., where an almost equal distribution was observed in either segments [27,28].

Therapeutic approaches that have been attempted for myocardial bridging include beta-blockers, calcium channel blockers, stents [29-36], minimally invasive Coronary Artery Bypass Grafting (CABG) [33], and surgical myotomy [34-39].

Some authors [31,39-41] reported the incidence of MB to be ranging from 0.6%-3.17%. In the present study, the incidence of MB was 5.50% that is higher than that reported in the previous studies in Indian scenario. The MB constricts the coronary arteries in systole whereas blood flow is normally in diastole; the mechanism of production of ischaemic heart disease has been debated. Bourassa MG et al., with the help of new cardiologic investigation facilities, found that systolic coronary artery compression leads to mid to late reduction of their diastolic diameter which might be responsible for cardiac compromise [42]. The segment proximal to the bridge frequently shows atherosclerotic changes, although the tunneled segment is typically spared. This is supported by effects at cellular and ultrastructural level [43,44].

The MB is a physiological entity offering maximum resistance to the coronary blood flow. In a normal condition, this resistance is negated by vessel dilatation in response to local metabolites. But with increasing age, this phenomenon is compromised which may lead to myocardial ischaemia. Hence, the knowledge of MBs is essential for cardiologists to detect aetiology of different heart related problems, to plan the mode of treatment and to predict their prognosis. Surgical approaches like coronary bypass, unroofing and myotomy are the treatment of choice for symptomatic MB [45]. High inflation pressures may be required to optimally implant the stent, which increases the risk of coronary perforation. The data collected until now demonstrated that the treatment of MB with stent implantation is not free from potential complications [46,47]. In the index study, none of the patients required percutaneous coronary or surgical intervention.

## Limitation(s)

As this was a retrospective study, the patients with MB could not be followed-up for progression of disease.

## CONCLUSION(S)

Clinical suspicion of MB should be considered in young patients with typical or atypical chest pain, where the probability of atherosclerosis is low and there are no other cardiovascular risk factors. The MB is a congenital anomaly but is symptomatic in third decade of life. Previously thought to be a benign condition, but it can be symptomatic. The recognition of this condition is very important and so is its management. This study observed higher proportion of MB in proximal and distal segment of LAD and diagonal arteries.

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