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Research Article

MORPHOLOGICAL STUDY ON MYOCARDIAL BRIDGES AND ITS CLINICAL SIGNIFICANCE

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ABSTRACT
Myocardial bridging is recognized as an anatomical variation of the human coronary circulation in which an epicardial artery lies in the myocardium for part of its course. Thus, the vessel is 'bridged' by myocardium. The present study is aimed to studying presence of myocardial bridges over coronary arteries and their branches by dissection method. A total of 50 adult human hearts (irrespective of sex) were collected from Department Of Anatomy, Govt. Medical College, Surat. The hearts were dissected along both the coronary arteries and its branches and presence, location, and length of the bridges were noted. The overall prevalence of myocardial bridges was found to be 52%. There was trifurcation of left coronary artery(LCA) in 2 specimens(4%).The left anterior descending branch of the left coronary artery has been reported as the most common site of myocardial bridges (46.15%) but other locations have been reported.The maximum length of myocardial bridge was 45 mm over posterior interventricular branch of right coronary artery. The purpose of this study was to provide more definitive information on the vessels with myocardial bridges and the length of bridge segment. Myocardial Bridge (MB) on the coronary artery is associated with ischemic heart disease and cardiomyopathy.

Key Words: *Coronary Arteries, Myocardium, Myocardial Bridge, Ischemic Heart Disease, Left Anterior Descending Artery*

INTRODUCTION
Myocardial Bridge (MB) can be defined as a band of myocardium which overlies on an intramural segment of coronary artery, i.e. this is a place where the coronary arteries instead of its epicardial course go within the myocardium. According to text (Gray's anatomy 39th edition) the coronary arteries may dip into the myocardium for varying lengths and then reappear on heart's surface. Myocardial bridges were first described by Rayman (1737) and then by the Black (1805). The first post mortem examination of myocardial bridges was performed by Geiringer (1951) and was followed by first radiological description by Portman and Ingrid (1960). Polacek (1961) believed that myocardial bridges played a role in sclerotic process because intimal hyperplasia was observed in pre bridge segment of coronary artery.
It is not an uncommon finding in routine diagnostic coronary angiography or pathological examination of heart. This phenomenon has been described by Rayman (1937). There is a wide difference between the incidences of MBs in autopsy studies (15–85%) and in angiographic studies (0.5–2.5%) (Bourassa *et al.,* 2003). The incidence of this anomaly is higher in women than in men. It is found in 5%-86% in anatomic studies but only observed in 0.5%-12% of patient undergoing coronary arteriography (Laifer *et al.,* 1991). During the last century, many investigators reported myocardial bridges in the adult human heart. The frequency of myocardial bridging varies widely. The present study has been undertaken for detailed anatomical study of myocardial bridges by dissection method.
The clinical significance of myocardial bridges is uncertain and many patients are asymptomatic (Kramer *et al.,* 1982). Myocardial bridges may be a contributing factor in the development of myocardial ischaemia, circulatory problems, angina, myocardial infarction, sudden cardiac death, systolic compression and other cardiac disturbances that may require surgical intervention (Visscher *et al.,* 1983). Conversely, it has been proposed that myocardial bridges offer a 'protective effect' from atherosclerosis within the coronary artery that is bridged when compared with non-bridged vessels of the same heart (Ishii *et al.,* 1986).

The focus of this study was therefore to offer a more complete description of the location of myocardial bridges in the adult human heart.

MATERIALS AND METHODS

A study conducted on 50 human cadaveric hearts collected from Department of Anatomy, Government Medical College, Surat and hearts were preserved in 10% formalin. The epicardium and fat were removed carefully from the surface of the heart. The origin and the course of all the coronary arteries and their important branches were carefully dissected by using artery forceps, blunt forceps and mosquito forceps. The left coronary artery along with its branches was dissected as it passed between auricle and pulmonary trunk. It was followed to its most distal end. The right coronary along with its branches was also dissected and followed to its most distal end. The presence, location and length of myocardial bridges were noted along with the course of the artery and its branches. Specimens showing myocardial bridges were photographed and numbered.

RESULTS AND DISCUSSION

Of the total 50 hearts dissected, 26 hearts showed myocardial bridges in at least one coronary artery or in one of its significant branches, the overall prevalence being 52%. Myocardial bridges were found to be more common in the major branches of Left Coronary Artery (73.07%) than that in Right Coronary Artery (26.92%), (Table-1).

Table 1: Showing incidence of myocardial bridges over coronary arteries

MYOCARDIAL BRIDGE	LCA(n=26)	RCA(n=26)
Number	19	7
Percentage(%)	73.07%	26.92%

Table 2: Comparison of incidence of myocardial bridges in different coronary arteries in different studies

Different Studies	incidence of mb(%)	lca				rca	
		Lad	ld	lm_x	lc_x	piva	rm_x
Present Study	52%	46.15%	11.53%	7.69%	7.69%	23.07%	3.84%
Bandyopadhyay *et.al.* ,2010	90.4%	86.84%	10.5%	10.5%	x	21.05%	15.78%
Loukas *et.al.* ,2006	34.5%	43.2%	17.2%	7.4%	6.1%	2.4%	4.9%
Bharambe *et.al.* ,2008	56%	46%	16%	8%	x	6%	x

Lca=left coronary artery, rca=right coronary artery, Lad=left anterior descending artery, ld=left diagonal artery, lm_x=left marginal artery, lc_x=left circumflex artery, piva=posterior interventricular artery, rm_x=right marginal artery

Though almost all the major branches were involved (Table-2), left anterior descending artery (left anterior interventricular artery) a branch from left coronary artery was significantly more involved than the others (Fig. 1). We found myocardial bridges in 19 of 26 specimens(73.07%) over left coronary artery.Out of this myocardial bridging was found in 12 specimens (46.15%) over its left anterior descending branch, in 3 specimens (11.53%) over its left diagonal branch, in 2 specimens (7.69%) over its left circumflex branch, in 2 specimens (7.69%) over its left marginal branch.

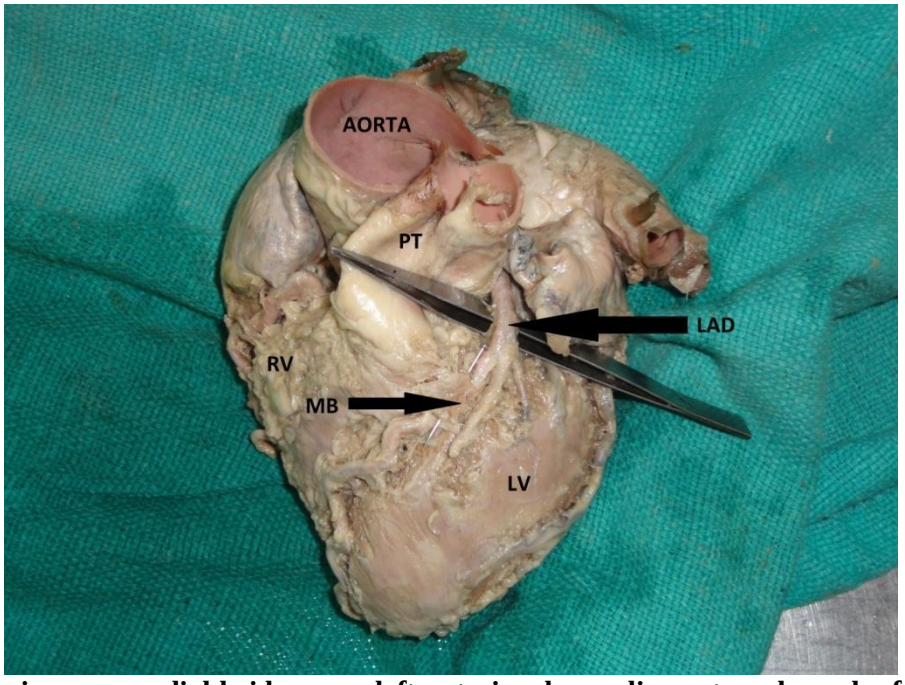

Figure 1: Showing myocardial bridge over left anterior descending artery, branch of left coronary artery. (LAD= left anterior descending artery, LV=left ventricle, RV=right ventricle, PT=pulmonary trunk, MB=myocardial bridge).

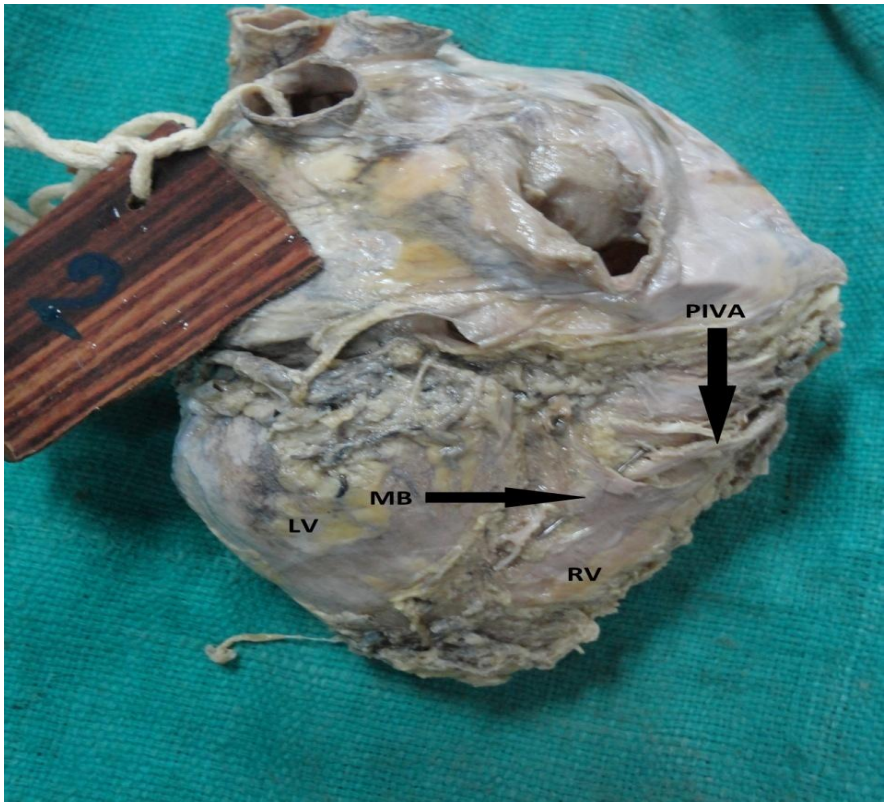

Figure 2: Showing myocardial bridge over posterior interventricular artery (PIVA), a branch of right coronary artery

We found myocardial bridges in 7of 26 specimens (26.92%) over right coronary artery.Out of this myocardial bridging was found in 6 specimens (23.07%) over its posterior interventricular branch (Fig. 2) in 1 specimen (3.84%) over its right marginal branch.
Maximum length of myocardial bridge was 45 mm and was found on posterior interventricular branch of right coronary artery (Fig. 3). The bridge length was characterized as short (less than 20 mm; 69.2%), intermediate (20 mm- 40 mm; 23.07%) and long (greater than 40 mm; 7.69%).
Myocardial bridges are more common in the middle 1/3 of left anterior descending artery (58.3%) as compared to and in distal (8.3%) and proximal part (33.3%) respectively (Table-3). We found trifurcation of left coronary artery (LCA) in 2 specimens (4%).

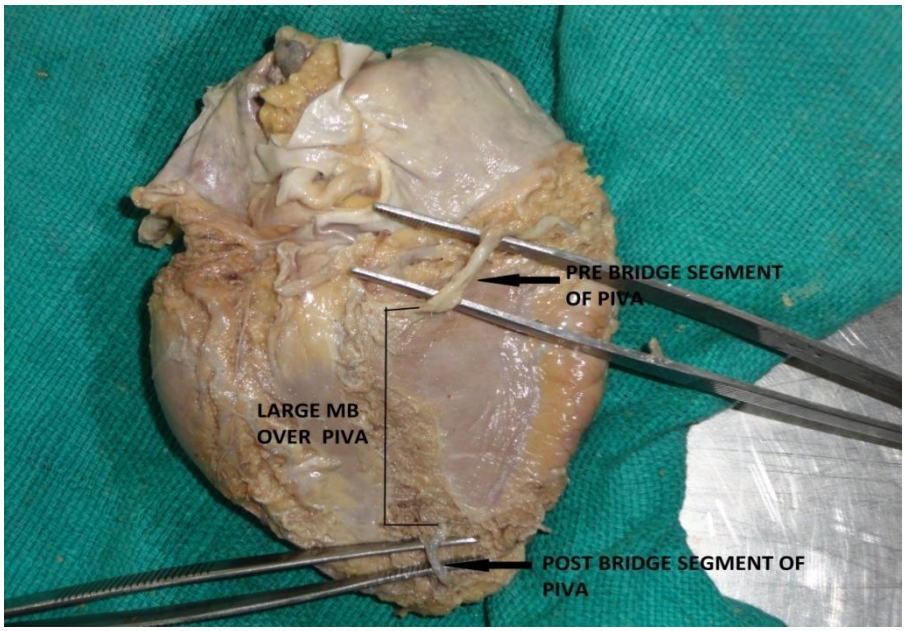

Figure 3: Showing maximum length of myocardial bridge over posterior interventricular artery (PIVA), a branch of right coronary artery

Table 3: Showing incidence of myocardial bridges over different segments of anterior interventricular artery

Different Studies	**anterior interventricular artery**		
	Proximal 1/3	**middle 1/3**	**distal 1/3**
Present study	33.33%	58.33%	8.33%
Vanildo ML *et.al.* ,2002	13.33%	86.66%	x
Bharambe VK *et.al.* ,2008	20%	28%	8%

Muscle fibers of myocardium overlying coronary artery were first mentioned by Reyman (1737). They were described as a 'myocardial bridges' by Geirringer in 1951. MB is an important cardiological entity which has led to many controversies. The incidence varies from report to report and seems to depend on the precision of the dissector. The morphological study on MB showed varied incidence rate—it was 23% in the study done by Geiringer (1951) 55.6% as per Ferreira *et al.*, (1991) and 56% as per Bharambe *et al.*, (2008). In our study, incidence rate was 52%.

Observation regarding myocardial bridges shows variations depending on the method used. In angiographic studies, the incidence of myocardial bridges was found 0.5–2.5% (Bourassa *et al.,* 2003). In present study done by dissection method the incidence of myocardial bridges was 52%. Angiographic search revealed more varied results. Harikrishnan *et al.,* (1999) had studied 3200 patients via angiography and found MBs in only 0.6% cases. Study by Zeina *et al.,* (2007) by computed tomographic angiography revealed MB in 26% cases. As only about two-third of MBs exhibits a 50% narrowing of the vessels, angiographic result may be different from those of morphological one. Since MBs might lead to various clinical scenarios and invites various modes of treatment to prevent those complications, a more meticulous study by computed tomography angiography might be necessary.

In our study we found trifurcation of left coronary artery in 2 specimens (4%) but in Saidi *et al.,* (2010). Eight hearts had trifurcation of the left coronary artery (LCA) (7.3%). Presumably, such arrangement ensures collateral conduits for myocardial perfusion when one of the Left coronary artery is occluded.

MBs were found to be significantly more common on the left anterior descending artery as per the previous studies as also in our study, lowest being 43.2% by Loukas *et al.,*(2006) though almost all the significant branches of both the coronary arteries were involved.

In present study, higher incidence of bridges was found over the middle 1/3 of anterior interventricular artery (58.33%). Vanildo *et al.,* (2002) and Bharambe *et al.,* (2008) also found higher incidence of bridging over middle 1/3 of anterior interventricular artery. In present study, 8.33% incidence of myocardial bridges over the distal 1/3 of anterior interventricular artery which corresponds with the Bharambe *et al.,* (2008).

In our study the maximum length was 45 mm over posterior interventricular branch of RCA. The length of the MB definitely plays a vital role in producing ischemic symptoms since a longer MB will produce more significant systolic compression on the coronary arteries (Bourassa *et al.,* 2003). MB constricts the coronary arteries in systole only whereas blood flow through them mainly takes place in diastole; the mechanism of production of ischemic heart disease had been debated. But finally Bourassa et al. 2003 with the help of new cardiologic investigation facilities asserted that, systolic coronary artery compression leads to mid to late reduction of their diastolic diameter which might be responsible for cardiac compromise.

The knowledge of MB is essential for cardiologists to detect etiology of different heart related problems, to plan the mode of treatment and to predict their prognosis.

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