

Myocardial Bridge: Findings of Postmortem Heart

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ABSTRACT

Background: - The myocardial bridges are the myocardium overlying coronary arteries. The coronary arteries may dip into the myocardium for varying lengths and then reappears on the heart's surface. **Aims:** The present study is aimed at studying the presence of myocardial bridges over coronary arteries and their branches by dissection method. **Material and Methods:** - A total of 50 adult hearts procured from dead bodies from the Mortuary of the Department of Forensic Medicine & Toxicology, CSM Medical University, Lucknow were included in this study irrespective of sex. The hearts were meticulously dissected along both the coronary arteries and the presence and location of myocardial bridges was noted along with the part of the artery and/or its branch it was crossing. **Results:** - The overall prevalence of myocardial bridging was found to be 42%. They were mostly seen over the left anterior descending coronary artery. In maximum cases, they were seen over the middle 3rd of the left anterior descending coronary artery. The reported incidence of myocardial bridges varies 5-58%. **Conclusion:** - They may be associated with a wide range of clinical problems, including acute coronary syndromes and arrhythmias. The contraction of the myocardial bridge may result in vessel compression and myocardial ischaemia. **Key words:** Myocardial bridges, heart, post mortem

INTRODUCTION

The myocardial bridges describe the situation in which part of the coronary arteries, running in epicardial tissue, traversed into the myocardium for varying lengths and then reappear on the heart's surface. The muscle overlying the intra myocardial segment of the epicardial coronary

artery is termed a myocardial bridge. The artery coursing within the myocardium is called a tunnelled artery. Myocardial bridge (MB) or tunnelled coronary artery is an inborn abnormality, which implicates a systolic vessel compression with a persistent mid-late diastolic diameter reduction. The myocardial bridges have been studied angiographically and by dissection method. There are variable reports about the incidence and effects of myocardial bridges. Myocardial bridges are often observed during coronary angiography with an incidence of 0.5%-5.5%. The most commonly involved coronary artery is the left anterior descending artery followed by the diagonal branches, the right coronary artery, and the left circumflex. The overall long-term prognosis is generally benign.¹

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Tunnelled coronary arteries have long been recognized anatomically.² The myocardial bridges with myocardial ischemia have heightened their clinical relevance.³

MATERIALS AND METHODS

The study was conducted on 50 human hearts at Department of Forensic Medicine & Toxicology and associated at Mortuary, of CSM Medical University, Lucknow during September 2008 to August 2009.

SELECTION OF CASES

Cases included 50 hearts of both sexes between the age group 30-60 years, having history of deaths due to natural as well as unnatural causes (accidental, suicidal, homicidal, etc.), brought to the mortuary, within 12 hours of death, for the autopsy examination. Decomposed bodies were excluded from the study.

PROCEDURES OF STUDY

The Hearts were dissected out with a portion of ascending aorta. Each heart was then thoroughly washed to get rid of the blood clots from its chambers. The specimens were then fixed in 10% formalin solution for 2-5 days. The visual

identification of the coronary sinuses, coronary arteries and their branches and muscle bridges were based on standard anatomical knowledge⁴. Photographs were taken of all the observations at different angles by a 7 MP X digital camera at 4x optical zoom.

The number and the length of all major arterial branches number and position of myocardial bridges were recorded. The lengths were obtained by measuring the entire course of the arteries from origin to the last point of naked eye identification⁵ by simple ruler. The branching pattern for the left coronary artery was documented based on its major (1st order) epicardial branches, the left anterior descending (LAD), and the circumflex (LCX) artery that were followed up-to termination and the geographic pattern of the branching determined.

The first order branches of the right coronary artery (RCA) were determined visually and carefully by following the main RCA trunk through its entire course to the posterior descending artery. The coronary artery was considered dominant if it gave the posterior descending artery. Co-dominance occurred as situations whereby both coronary arteries gave posterior descending artery⁵.

OBSERVATIONS

The hearts of 50 cases including 43 of males and 7 of females were selected for study. Out of the

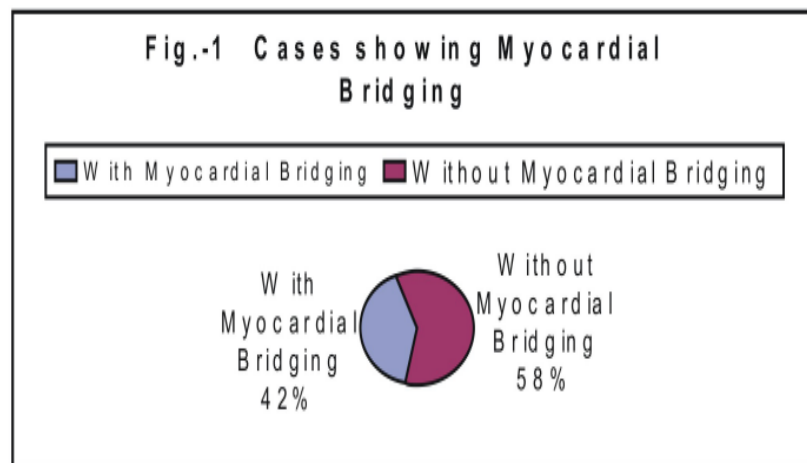


Table -I Comparison of incidence of Myocardial bridges over LCA and RCA

Heart showing myocardial bridges (No.=21)		
LCA Only No. = 15	LCA & RCA Both No. = 4	Only RCA No.=1
LAD Artery	LAD & 1 st segment of RCA	PIV branch of RCA
15 (71.43 %)	4 (19%)	1 (4.76%)

LCA - Left Coronary Artery, LAD- Left Anterior Descending, RCA - Right Coronary Artery, PIV - Posterior Inter ventricular

The table-II showing the distribution of myocardial bridges over LAD artery. The maximum incidences were seen in 11 cases (55%) on the middle 1/3rd, followed by 9 cases (45%) on proximal 1/3rd while there was no myocardial bridging found on the distal 1/3rd of the LAD artery.

Table - II Distribution of myocardial bridges over LAD artery

Cases showing Myocardial Bridging over LAD (No.= 20)		
Proximal 1/3rd	Middle 1/3rd	Distal 1/3rd
9 (45%)	11 (55%)	Nil (%)

LAD =Left Anterior Descending

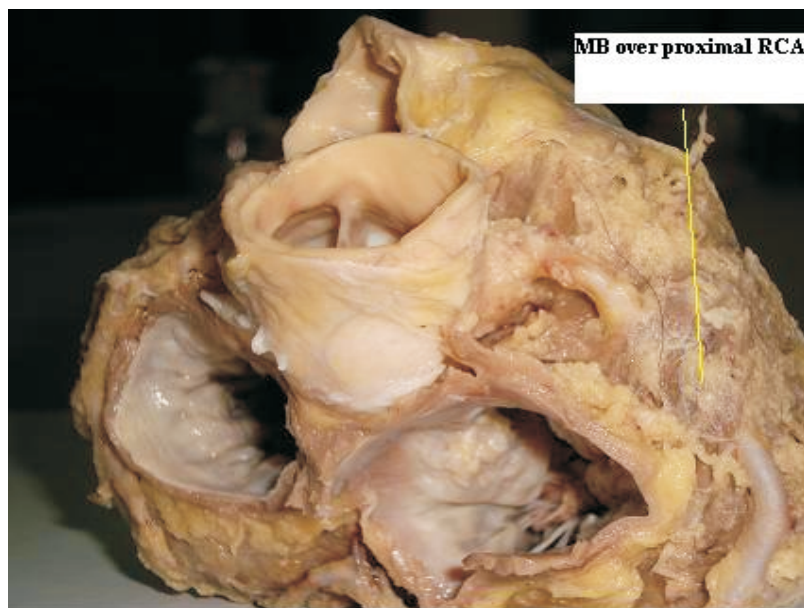
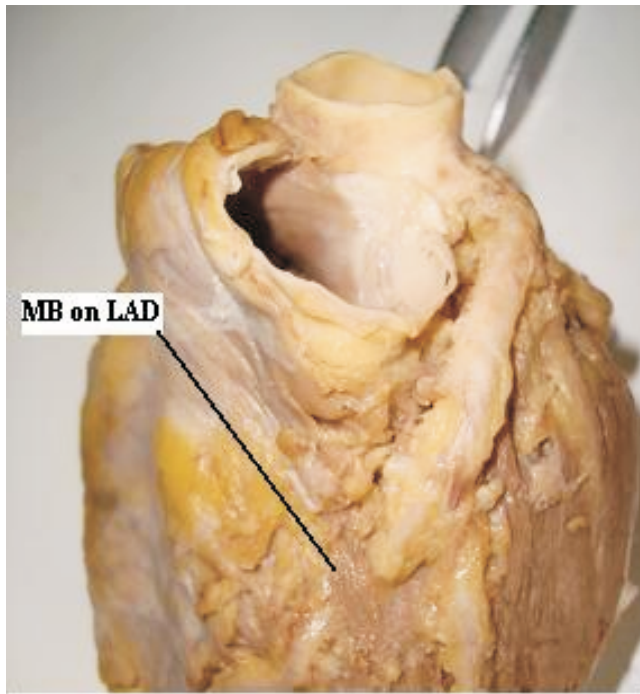
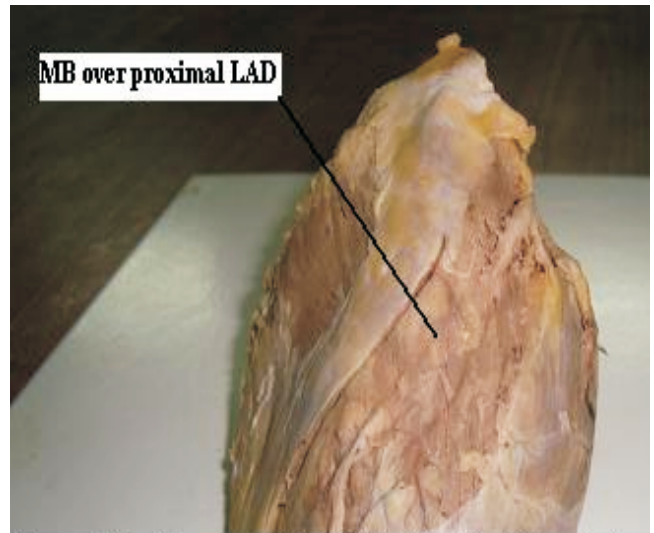
**Right Lateral Aspect of Heart showing Myocardial Bridge over proximal RCA****Figure- 2**

Figure 3



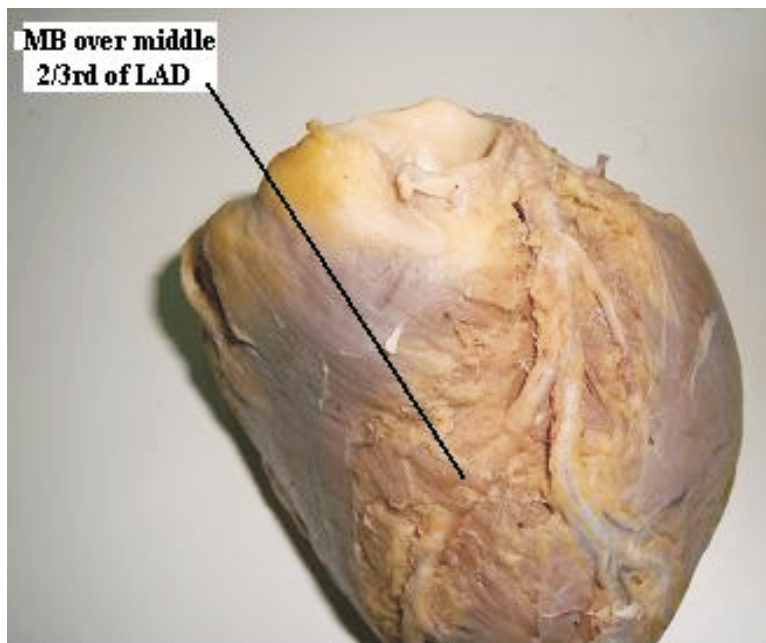
Anterior surface of heart showing Myocardial bridge on Lower 1/3rd of Left Anterior Descending Artery

Figure - 4



Myocardial bridges on proximal 1/3rd of Left Ant. Desc. Artery

Figure - 5



Anterior surface of Heart showing Myocardial bridge over LAD

total 50 hearts, 21 (42%) hearts were showed the presence of myocardial bridges (Fig. -1) out of which there were 20 males and only 1 female showed the myocardial bridges.

Amongst 21 hearts those showed the presence of myocardial bridges, majority 15 hearts (71 %) were showed the myocardial bridges on the left anterior descending artery (LAD) of left coronary of arteries (LCA), hearts of 4 cases (19%) showed in both left coronary of arteries (LCA) and right coronary artery (RCA), and only in a single case (4.76 %) of myocardial bridge was present only on the posterior inter ventricular branch of the right coronary artery (RCA) (Table-1). Out of the 21 hearts those 4 cases showed the myocardial bridges on both the left coronary of arteries (LCA) and right coronary artery (RCA), showed myocardial bridges both on LAD as well as 1st segment of the right coronary artery (Table- I).

DISCUSSION

Reyman *et al*⁶ had first time mentioned about the muscle fibres of myocardium overlying coronary artery. These muscle fibres of myocardium were described as 'myocardial bridges' by Geiringer⁷ in 1951. Table III depicts the incidence of myocardial bridges reported since the earliest studies on the same and compared with the present study (Ref. Table nos. I &II).

There are variable incidences of myocardial bridges reported angiographically and by dissection method. The incidence of myocardial bridging in present study (table III) is greater than the incidence reported by Loukas *et al*⁸, Pelech *et al*⁹ and Geiringer⁷ using the dissection method of study. The incidence of myocardial bridges can be explained to some extent by the development of coronary vessel systems described by Reese *et al*¹⁰. He states that in the earliest stages of cardiogenesis the heart is tubular and made up of an endothelial tube within a muscular tube. At this stage there is no epicardium. The cells forming the epicardium arise from an outgrowth called Pro-epicardial organ from the septum transversum. These cells migrate to envelope the heart to form the epicardium and pericardium.

Signalling mechanisms regulate the migration of the epicardial cells which in turn give out the signals that participate in regulation of myocyte proliferation, growth and final pattern of myocardium. The epicardial cells undergo epithelial-to-mesenchymal transition. This is controlled by various factors from the myocardium. The mesenchymal cells migrate through the spaces generated in the developing myocardium and forming finally the coronary arterial system. This migration of these mesenchymal cells through the developing myocardium could explain the embryogenesis of myocardial bridges over portions of the coronary arteries.

High incidences of 'myocardial bridges over left anterior descending artery' reported in the present study correlates with the findings of Vaishaly & Arole V.¹¹, Geiringer⁷, Pelech *et al*⁹ & Loukas *et al*⁸. In the study conducted by Angelini *et al*¹² and Harikrishan¹³ using the method of angiography all the bridges reported were on the left anterior descending artery but the incidence was lowest i.e. 5.50% and 0.6% respectively. While in the present study, the highest incidence of myocardial bridges (22%) was observed over the middle 1/3rd of the left anterior descending artery. Vaishaly & Arole V.¹¹ and Vanildo *et al*¹⁴ also reported a high incidence of bridging over the middle 1/3rd of the left anterior descending artery. In present study, there was no bridging on the distal 1/3rd of the left anterior descending artery. Vanildo *et al*¹⁴, also not reported bridging over distal 1/3rd of the left anterior descending artery.

The findings of the present study showed that the incidence of myocardial bridging on the posterior inter-ventricular branch of right coronary artery was 4.76%, and over the 1st segment of right coronary artery, it was 19.04%. Similar findings also reported by Vaishaly & Arole V.¹¹ and Loukas *et al*⁸.

The tunnelled coronary arteries are presumed to be congenital in origin. At least three factors are postulated to account for differences between the high frequency of the tunnelled major coronary

arteries observed at necropsy and lower frequency of the tunnelled coronary arteries observed angiographically¹⁵⁻¹⁶ these factors are 1) length of the tunnelled coronary segment, 2) degree of systolic compression, and 3) heart rate. Longer tunnelled segment of coronary arteries, more severe systolic diameter narrowing of the tunnelled segment and tachycardia may contribute to the production of myocardial ischemia with myocardial bridging³. The length of coronary tunnelling may not always be an important factor in causing myocardial ischemia, as three cases with left main intra-myocardial tunnelling of greater than 40mm have been described without evidence of myocardial ischemia³.

Lovell & Knight CJ¹⁷ stated that though myocardial bridges may cause clinically relevant problems, including acute coronary syndromes and arrhythmias, have been reported in patients whose sole apparent cardiac abnormality is the presence of myocardial bridge.

Morales AR et al.¹⁸ and Cutler D et al¹⁹ have described sudden death in myocardial bridging. Bridging also occurs in 30-60% of individuals with hypertrophic obstructive cardiomyopathies.

SIGNIFICANCE OF MYOCARDIAL BRIDGES

Myocardial bridging, a congenital coronary anomaly, is a clinical condition with several possible manifestations, and its clinical relevance is debated. With each systole, the coronary artery is compressed. Myocardial bridging has been associated with angina, arrhythmia, depressed left ventricular function, myocardial stunning, and early death after cardiac transplantation, and sudden death. Evidence indicates that the intima beneath the bridge is protected from atherosclerosis, and the proximal segment is more susceptible to development of atherosclerotic lesions because of haemodynamic disturbances. Medical treatment generally includes beta-blockers. Nitrates should be avoided because

TABLE III: Previous reported incidence & distribution of myocardial bridges

	% Incidence of MB	LCA					RCA	
		Proximal 3 rd of LAD	Middle 3 rd of LAD	Distal 3 rd of LAD	Diagonal Br.	Marginal br. of LCX	PIV br. of RCA	1 st segment of RCA
Findings based on Dissection Method								
Present study, 2009	42%	45%	55%	nil	Nil	nil	4.76%	19.05%
Vaishaly K, 2007 ¹¹	56%	20%	28%	8%	16%	8%	6%	4%
Geiringer, 1951 ⁷	23%	Over AIV artery						
Ferreira 1991 ²⁰	57%	Arteries not specified						
Reig, 1993 ²¹	58%	All coronary arteries						
Vanildo, 2002 ¹³		Out of total hearts showing MB						
		13%	87%	nil				
Pelech 2006 ⁹	5%-25%	AIV						
Loukas, 2006 ⁸	34%	17%			7%	3%	4%	7.5%
Findings based Angiographic method								
Angelini 1983 ¹²	6%	Over AIV artery						
Harikrishan 1999 ¹³	0.60%	All the MB were observed were over the AIV artery						

AIV= Anterior Interventricular

symptoms may worsen. Intracoronary stents and surgery have been attempted in selected patients.

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